MANAGEMENT ACCOUNTING

(Theory, Problems and Solutions)

CMA M N Arora

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For B.Com., Delhi University
(As per CBCS Syllabus)

MANAGEMENT ACCOUNTING

THEORY, PROBLEMS AND SOLUTIONS

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Preface to the First Edition

Management accounting is a fast growing and high value subject and all commerce graduates must possess knowledge of concepts, techniques and practices of this subject. It helps in planning and controlling of business operations and also in management decision making, which in turn assists in profit maximisation for the business. This book is an attempt to provide the students with thorough understanding of the management accounting concepts, methods and techniques. The subject matter has been presented in a systematic and intelligible manner with liberal use of numerical illustrations, charts and diagrams so as to make it interesting and sustain readers' interest.

The book has been divided into seven chapters as per the syllabus of B.Com., Delhi University. Based on the conviction that students can really learn management accounting by solving problems, the theory and problems approach has been adopted to fully meet all the examination needs of the students in this volume. Thus, apart from well organised theory, this book has more than 200 solved problems and illustrations and more than 160 unsolved problems with answers and hints, apart from more than 140 objective type questions and more than 100 selected theory questions. This will help students tackle examination questions with ease. The theory questions and practical problems and illustrations have been mostly selected from B.Com., BBA, CA, CS, ICWA and other examinations.

I am confident that with all these distinctive features, the students and teachers will find the book extremely useful and rewarding. I invite them to send their constructive and helpful suggestions and also errors in the book at the address given below. These will be gratefully acknowledged and used for improvement of this book in future editions.

I am grateful to the staff of Himalya Publishing House particularly Mr. Niraj Pandey for their cooperation and producing this book in a beautiful get-up.

M. N. Arora

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Delhi University CBCS Syllabus

MANAGEMENT ACCOUNTING

B.COM.: SEMESTER VI

PAPER BC 6.1 (c): MANAGEMENT ACCOUNTING

Duration : 3 hours *Max. Marks: 75*

Objective: To provide the students knowledge about use of costing data for planning, control and decision making.

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Unit I:

Nature and Scope: Difference between cost accounting and management accounting, relationship between financial accounting and management accounting, need, importance, limitations of management accounting, cost control, cost reduction, cost management.

Unit II:

Budgeting and budgetary control: Concept of budget, budgeting and budgetary control, objectives, merits and limitations. Budgeting vs. forecasting, budgeting process, functional budgets, cash budget, fixed and flexible budgets, zero base budget, programme and performance budgets.

Unit III:

Standard costing and variance analysis: Meaning of standard cost and standard costing; advantages, limitations and applications. Variance analysis - material, labour, overhead and sales variances, disposition of variances, control ratios.

Unit IV:

Absorption versus variable costing: Distinctive features and income determination. Cost-volume-profit analysis: break-even analysis. Contribution/sales ratio, key factor, margin of safety, angle of incidence, determination of cost, indifference point.

Unit V:

Decision making: Costs for decision making, variable costing and differential analysis as aids in making decisions — fixation of selling price, exploring new market, make or buy, product mix, operate or shut down, sell or process further. Responsibility accounting, divisional performance measurement.

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CHAPTER 1

NATURE AND SCOPE OF MANAGEMENT ACCOUNTING

CHAPTER OUTLINE

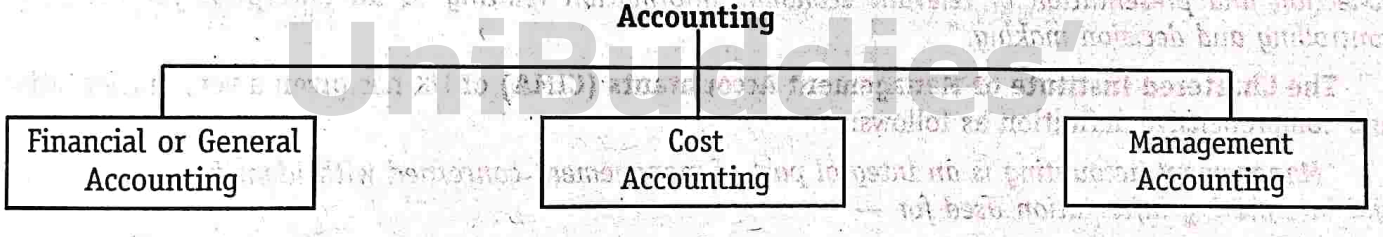
Introduction; Meaning and definition of management accounting; Nature of management accounting; Scope of management accounting; Ojectives or functions; Tools and techniques used in management accounting; Comparison with financial accounting; Comparison with cost accounting; Limitations; Cost control and Cost reduction; Cost management; Key terms; Examination questions.

"The most exciting and innovative work in management today is found in accounting"

Peter F. Drucker

Introduction

Accounting is broadly divided into three branches:



FINANCIAL ACCOUNTING

Financial accounting is concerned with recording business transactions in the books of account for the purpose of determing the profit or loss and financial position of the business. The information supplied by financial accounting is summarised in the following two statements at the end of the accounting period, generally one year.

(*a*) *Profit and Loss Account* showing the net profit or loss during the period.

(*b*) *Balance Sheet* showing the financial position of the firm at a point of time.

The objective of financial accounting is to provide information to external parties such as shareholders, creditors, employees, potential investors, government agencies, etc.

COST ACCOUNTING

Cost accounting is a branch of accounting which specialises in providing information about the detailed cost of products or services being supplied by the undertaking. It consists of principles and rules which are used for determining:

(*a*) the cost of manufacturing a product; *e.g.*, motor car, furniture, chemical, steel, paper, etc. and

(*b*) the cost of providing a service; *e.g.*, electricity, transport, education, etc.

Cost accounting information is mainly for internal use *i.e.* for management. It is not to be provided to external parties such as shareholders, creditors, potential investors, etc. Neither do they have any claim on this information, excepting government agencies, to whom cost information may have to be submitted.

MANAGEMENT ACCOUNTING

Meaning and Definition

The term 'management accounting' is the modern concept of accounts as a tool of management. It is a broad term and is concerned with all such accounting information that is useful to management. In simple words, the term management accounting is applied to the provision of accounting information for management activities such as planning, controlling and decision-making, etc.

In the words of **Robert Anthony**, *"Management accounting is concerned with accounting information that is useful to management."*

According to the **Institute of Chartered Accountants of England**, *"any form of accounting which enables a business to be conducted more efficiently"* may be regarded as management accounting. Management accounting information can help managers identify problems, solve problems and evaluate performance.

The Institute of Cost Accountants of India has defined management accounting as *"a system of collection and presentation of relevant economic information relating to an enterprise for planning, controlling and decision making."*

The Chartered Institute of Management Accountants (CIMA) of UK has given a very authoritative and comprehensive definition as follows:

"Management accounting is an integral part of management concerned with identifying, presenting and interpreting information used for —

(*i*) formulating strategy;
(*ii*) planning and controlling activities;
(*iii*) decision-making:
(*iv*) optimising the use of resources;
(*v*) disclosure to shareholders and others external to the entity:
(*vi*) disclosure to employees; and
(*vii*) safeguarding assets."

According to **National Association of Accountants** (USA), management accounting is *"the process of identification, measurement, accumulation, analysis, preparation and communication of financial information used by management to plan, evaluate and control within the organisation and to assure appropriate use and accountability for its resources.*

These definitions make it clear that management accounting plays a vital role in providing the necessary information to managers in performing their functions of planning, controlling, organising and

decision-making. Management accounting should serve as a decision support system to all levels of management.

Relationship of Financial Accounting, Cost Accounting and Management Accounting

The three types of accounting, *i.e.*, financial accounting, cost accounting and management accounting are closely linked. The management accounting uses the principles and practices not only of cost accounting but also of financial accounting. Information provided by financial accounting proves extermely useful for management accounting. For example, Profit and Loss account and Balance Sheet become the basis of ratio analysis and comparative financial statements, etc, which are used by the management accounting as important tools of planning and control. Financial accounting records also become basis of preparing detailed cost computation and reports. Cost accounting is a more detailed application of financial accounting and provides detailed cost information about products, services, departments, etc. This information is used by management accounting for planning, controlling and decision making purposes. Fig. 1.1 shows the evolution of management accounting and its relationship to cost accounting and financial accounting.

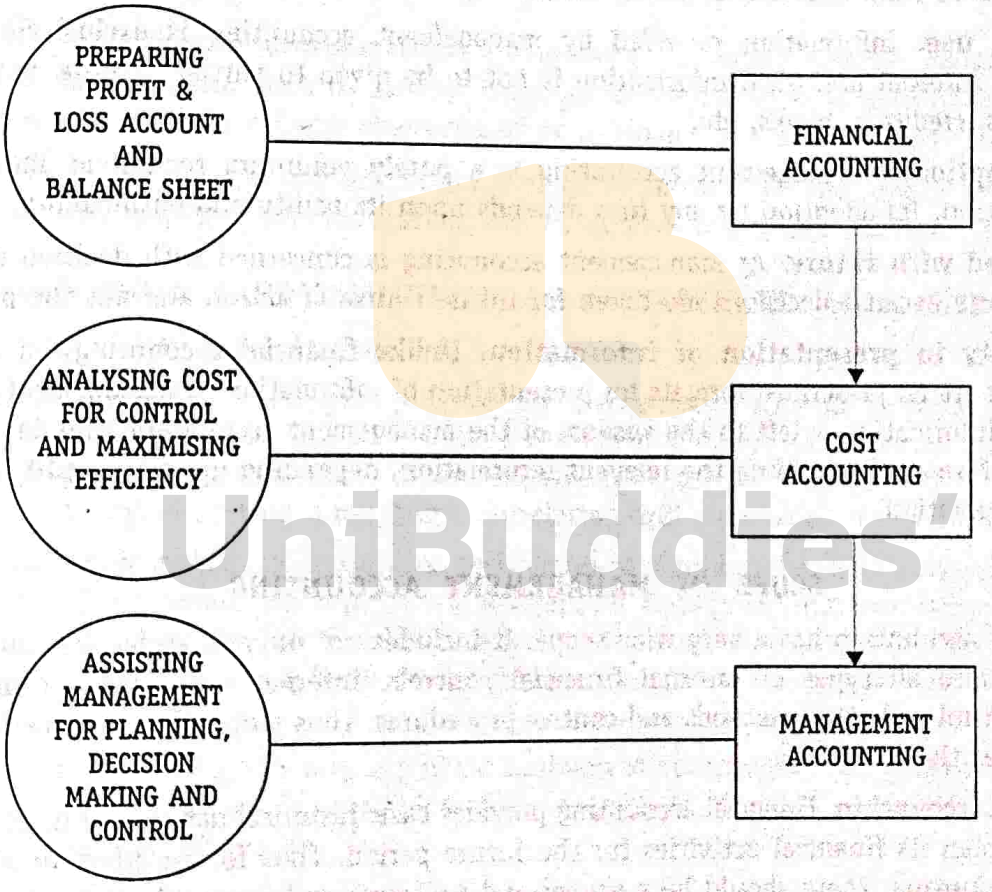

PREPARING PROFIT & LOSS ACCOUNT AND BALANCE SHEET
FINANCIAL ACCOUNTING
ANALYSING COST FOR CONTROL AND MAXIMISING EFFICIENCY
COST ACCOUNTING
ASSISTING MANAGEMENT FOR PLANNING, DECISION MAKING AND CONTROL
MANAGEMENT ACCOUNTING

Fig. 1.1. Relationship of Financial, Cost and Management Accounting.

Management Accountant is The Controller

In USA, the management accountant is called *'Controller'* or *'Financial Controller'* and is a part of the top management team.

Management accountant plays a very important role in an organisation. He analyses and interprets accounting information and meets the informational needs of management at different levels. In an organisation, a management accountant generally performs a staff function i.e. advisory role. But if he

is permitted to participate in planning and decission making, he is a part of the management team and thus becomes a part of the line function. It is very important that status of the management accountant in the organisation is clearly defined so that the scope of his work and responsibilities are accordingly determined.

CHARACTERISTICS OR NATURE OF MANAGEMENT ACCOUNTING

It is clear from the definitions of management accounting that it is concerned with accounting data that is useful in decision making. The main characteristics of management accounting are as follows :

1. Useful in decision making. The essential aim of management accounting is to assist management in decision making and control. It is concerned with all such information which can prove useful to management in decision making.

2. Financial and cost accounting information. Basic accounting information useful for management accounting s derived from financial and cost accounting records.

3. Internal use. Information provided by management accounting is exclusively for use by management for internal use. Such information is not to be given to parties external to the business like shareholders, creditors, banks, etc.

4. Purely optional. Management accounting is a purely voluntary technique and there is no statutory obligation. Its adoption by any firm depends upon its utility and desireability.

5. Concerned with future. As management accounting is concerned with decision making, it is related with future because decisions are taken for future course of action and not the past.

6. Flexibility in presentation of information. Unlike financial accounting, in management accounting there are no prescribed formats for presentation of information to management. The form of presentation of information is left to the wisdom of the management accountant who decides which is the most useful format of providing the relevent information, depending upon the utility of each type of form and information.

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SCOPE OF MANAGEMENT ACCOUNTING

Management accounting has a very wide scope. It includes not only financial accounting and cost accounting but also all types of internal financial controls, internal audit, tax accounting, office services, cost control and other methods and control procedures. Thus scope of management accounting, *inter alia* includes the following:

1. Financial accounting. Financial accounting provides basic historical data which helps management to forecast and plan its financial activities for the future period. Thus for an effective and successful management accounting, there should be a proper and well designed financial accounting system.

2. Cost accounting. Many of the techniques of cost control like standard costing and budgetary control and techniques of profit planning and decision-making like marginal costing, CVP analysis and differential cost analysis are used by the management accounting.

3. Budgeting and forecasting. In order to plan business activities for the future, forecasting and budgeting play a very significant role. Forecasting helps in the preparation of budgets and budgeting helps management accountant in exercising budgetary control.

4. Tax planning. In order to take advantage of various provisions of tax laws, management

accountant has to depend upon tax accounting and planning to minimise its tax liabilities and save more funds for the business.

5. Reporting to management. For effective and timely decisions, there should be a system of prompt and intelligent reporting to management. Both routine and special reports are prepared for submission to top management, middle order management and operating level management depending on their requirements.

6. Cost control procedures. Any system of management accounting is incomplete without effective cost control procedures like inventory control, labour control, overhead control, budgetary control, etc.

7. Statistical tools. Various tools of analysing and presenting statistical data like graphs, tables, charts, etc., are used in preparing reports for use by the management.

8. Internal control and internal audit. Management accountant heavily depends on internal financial controls like internal audit and internal check to plug loop holes in the financial system of the concern.

9. Financial analysis and interpretation. Management accountant employs various techniques to analyse and interpret financial data to make it understandable and useable to the management. Such analysis helps management to achieve objectives of management in a more efficient manner.

10. Office services. Management accountant is expected to maintain and control office routines and procedures like filing, copying, communicating, electronic data processing and other allied services.

FUNCTIONS (AND OBJECTIVES) OF MANAGEMENT ACCOUNTING

Main functions of management accounting are as follows:

1. Planning. Information and data provided by management accounting helps management to forecast and prepare short-term and long-term plans for the future activities of the business and formulate corporate strategy. For this purpose management accounting techniques like budgeting, standard costing, marginal costing, probability, correlation and regression, etc., are used.

2. Coordinating. Management accounting techniques of planning also help in coordinating various business activities. For example, while preparing budgets for various departments like production, sales, purchases, etc., there should be full coordination so that there is no contradiction. By proper financial reporting, management accounting helps in achieving coordination in various business activities and accomplishing the set goals.

3. Controlling. Controlling is a very important function of management and management accounting helps in controlling performance by control techniques such as standard costing, budgetary control, control ratios, internal audit, etc.

4. Communication. Management accounting system prepares reports for presentation to various levels of management which show the performance of various sections of the business. Such communication in the form of reports to various levels of management helps to exercise effective control on various business activities and successfully running the business.

5. Financial analysis and interpretation. In order to make accounting data easily understandable, the management accounting offers various techniques of analysing, interpreting and presenting this data in non-accounting language so that every one in the organisation understands it. Ratio analysis, cash flow and funds flow statements, trend analysis, etc., are some of the management accounting techniques which may be used for financial analysis and interpretation.

6. Qualitative information. Apart from monetary and quantitative data, management accounting provides qualitative information which helps in taking better decisions. Quality of goods, customers and employees, legal judgements, opinion polls, logic, etc., are some of the examples of qualitative information supplied and used by the management accounting system for better management.

7. Tax policies. Management accounting system is responsible for tax policies and procedures and supervises and coordinates the reports prepared by various authorities.

8. Decision-making. Correct decision-making is crucial to the success of a business. Management accounting has certain special techniques which help management in short-term and long-term decisions. For example, techniques like marginal costing, differential costing, discounted cash flow, etc., help in decisions such as pricing of products, make or buy, discontinuance of a product line, capital expenditure, etc.

Tools and Techniques used in Management Accounting

Management accounting uses a number of tools and techniques to help management in achieving business goals. Some of the important tools and techniques are as follows:

1. Budgeting
2. Standard costing and variance analysis.
3. Marginal costing and cost volume profit analysis.
4. Ratio analysis.
5. Comparative financial statements.
6. Differential cost analysis.
7. Funds flow statement.
8. Cash flow statement.
9. Responsibility accounting.
10. Accounting for price level changes.
11. Statistical and graphical techniques.
12. Discounted cash flow.
13. Risk analysis.
14. Learning curve.
15. Value analysis.
16. Work study, etc.

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COST ACCOUNTING AND MANAGEMENT ACCOUNTING — DIFFERENCE

An examination of the meaning and definitions of cost accounting and management accounting indicates that the distinction between the two is quite vague. Many eminent writers even consider these two areas as synonymous while others distinguish between the two. Horngren, a renowned author on the subject, has gone to the extent of saying, *"Modern cost accounting is often called management accounting. Why ? Because cost accountants look at their organisation through manager's eyes."* Thus managerial aspects of cost accounting are inseparable from management accounting. One point on which all agree is that these two types of accounting do not have clear cut territorial boundaries. However, distinction between cost accounting and management accounting may be made on the following points:

Basis	*Cost Accounting*	*Management Accounting*
1. **Scope**	Scope of cost accounting is limited to providing cost information for managerial uses.	Scope of management accounting is broader than that of cost accounting as it provides all types of information, *i.e.*. cost accounting as well as financial accounting information for managerial uses.
2. **Emphasis**	Main emphasis is on cost ascertainment and cost control to ensure maximum profit.	Main emphasis is on planning, controlling and decision-making to maximise profit.
3. **Techniques employed**	Various techniques used by cost accounting include standard costing and variance analysis, marginal costing and cost volume profit analysis, budgetary control, uniform costing and inter-firm comparison, etc.	Management accounting also uses all these techniques used in cost accounting but in addition it also uses techniques like ratio analysis, funds flow statement, statistical analysis, operations research and certain techniques from various branches of knowledge like mathematics, economics, etc., whichsoever can help management in its tasks.
4. **Evolution**	Evolution of cost accounting is mainly due to the limitations of financial accounting.	Evolution of management accounting is due to the limitations of cost accounting. In fact, management accounting is an extension of the managerial aspects of cost accounting.
5. **Statutory requirements**	Maintenance of cost records has been made compulsory in selected industries as notified by the Govt. from time to time.	Management accounting is purely voluntary and its use depends upon its utility to management.
6. **Data base**	It is based on data derived from financial accounts.	It is based on data derived from cost accounting, financial accounting and other sources.
7. **Status in organisation**	In the organisational set up, cost account-ant is placed at a lower level in hierarchy than the management accountant.	Management accountant is generally placed at a higher level of hierarchy than the cost accountant.
8. **Installation**	Cost accounting system can be installed without management accounting.	Management accounting cannot be installed without a proper system of cost accounting.

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LIMITATIONS OF MANAGEMENT ACCOUNTING

Management accounting is a very useful tool of management. However, it suffers from certain limitations as stated below :

1. Based on historical data. Management accounting helps management in making decisions for the future but it is mainly based on the historical data supplied by financial accounting and cost accounting. This implies that historical data is used for making future decisions. The accuracy and dependability of such data will leave their mark on the quility of managerial decisions. In other words, if past data is not accurate, management decisions may not be correct.

2. Lack of wide knowledge. The management accountant should have knowledge of not only financial and cost accounting but also many allied subjects like economics, management, taxation, statistical and mathematical techniques etc. Lack of knowledge of these subjects on the part of management accountant limits the quality of management accounting.

3. Complicated approach. Management accounting provides mass of data using various acounting and non-accounting subjects for decision making purpose. But sometimes management avoids this complicated and lengthy course of decision making and makes decisions based on intuition. This leads to unscientific approach to decision making.

4. Not a substitute of management. Management accounting only provides information to management for decision making but it is not a substitute of management and administration.

5. Costly system. The installation of management accounting system in an organisation is a costly affair as it requires a wide net-work of management information system, rules and regulations. All this requires heavy investment and small concerns may not be able to afford it.

6. Developing stage. Management accounting is a relatively recent development and it has not fully developed as yet. This limits the utility of this system to management in making perfect and correct decisions.

7. Lack of objectivity. The interpretation of information provided by management accounting may be influenced by personal bias of the interpreter of data. This tells upon the quality of managerial decisions.

8. Resistance from staff. The existing accounting and management staff may not welcome the introduction of management accounting system. This may be because they look at the system with suspicion that it will add to their work and responsibilities.

COST REDUCTION AND COST CONTROL

Now-a-days businesses are operating in a globally competitive environment, where in order to increase profits, increase in selling prices of products/services may not be possible because of fears of shrinkage in volumes. Thus in order to improve profit performance, businesses have to be extremely cost conscious and improve their performance in cost. In other words, in this age of competition, in order to survive and improve profitability, managers have to make continuous efforts to find out ways and means to *control* and *reduce costs.*

COST CONTROL

Cost control is an essential component of any system of cost accounting. It is exercised through comparing actual costs with pre determined standard costs so that the difference between the two can be measured and then analyzed according to reasons for taking corrective action. CIMA, London has defined cost control as, *"the regulation by executive action of the cost of operating an undertaking particularly where action is guided by cost accounting".* Cost control is thus simply the utilisation of the available resources economically and prevention of the wastage within the existing environment. It is the function of keeping costs within the prescribed limits.

Steps in Cost Control : In designing a system of cost control, the following steps are taken :

1. ***Establishing norms :*** The first step in cost control is to set norms or standards which may serve as yardsticks for measuring performance. These standards or norms are set on the basis of past performance adjusted for changes in future and on the basis of studies conducted.
2. ***Comparison with actual :*** The actual costs incurred are compared with established standard costs to know the level of achievement. The variations are analysed so as to arrive at the causes which are controllable and uncontrollable.
3. ***Corrective action :*** Remedial or corrective measures are taken to avoid the recurrence of variations is future and for revision of standards, wherever necessary.

Amongst the techniques used for cost control, the two most popular are budgetary control and standard costing.

COST REDUCTION

Cost reduction is often confused with cost control. Cost reduction is much wider in scope and consists of effecting savings in cost by continuous research for improvement in products, methods, procedures and organisational practices. Cost reduction is defined by C.I.M.A. London as *"the achievement of real and permanent reduction in the unit cost of goods manufactured or services rendered without impairing their suitability for use intended."* This definition reveals the following characteristics of cost reduction:

(*i*) Cost reduction must be real – say, through increase in productivity, change in product design, improvement in technology, etc.

(*ii*) Cost reduction must be permanent — temporary reductions in cost due to windfalls, change in tax rates, changes in market prices, etc., do not come in the purview of cost reduction.

(*iii*) Cost reduction must not impair the suitability of products or services for the intended use. In other words, cost reduction should not be at the cost of essential characteristics of the products or services.

The cost reduction is, therefore, the term used for planned and positive approach to the improvement of efficiency. It can be viewed in many ways, such as increasing productivity, elimination of waste, improvement in product design, better technology and techniques, incentive schemes, new layouts and better methods, etc. If the cost reductions are not based on sound reasons, like improved methods, then very quickly the costs will grow back to their original size.

Cost Control and Cost Reduction — Comparison

Cost control and cost reduction are two effective tools of cost management to improve efficiency. Cost control and cost reduction are two separate phases of cost improvement. Cost reduction begins where cost control ends. The main points of distinction between the two are as follows:

1. **Cost control** is the achievement of pre-determined targets of costs.
   Cost reduction is the achievement of the real and permanent reduction in costs.
2. **Cost control** tends to assume a static state of affairs and that standards once set are not challenged.
   Cost reduction assumes the existence of concealed potential savings in the standards or pre-determined costs set for cost control and that these standards are always subject to challenge.
3. **Cost control** is concerned with predetermining costs, comparing it with actual costs, analyzing the variances and taking corrective action.
   Cost reduction is not concerned with maintenance of performance according to predetermined targets. It is rather concerned with finding out new product designs, methods, etc.

4. **Cost control** is a preventive function as it aims to prevent the costs from exceeding the predetermined targets.
   Cost reduction is a corrective function because it challenges the predetermined targets and seeks to improve performance by correcting the targets.
5. **Cost control** is a part of cost accounting function.
   Cost reduction may be achieved even when no cost accounting system is in operation.
6. **Cost control** lacks dynamic approach to cost improvement.
   Cost reduction is a more dynamic approach to cost improvement and elimination of waste.

Scope and Areas of Cost Reduction

The scope of cost reduction is so wide that it is not practicable to develop fully the areas in which cost reduction may be applied. Wherever costs are incurred, there is scope for their reduction and the management should not feel that there is no room for cost reduction in any particular area. Effort should, therefore, be made to reduce costs right from the top level to the shop floor level. However, in the following areas, scope of cost reduction is the largest :

1. Product design. The design of the product provides the greatest scope for cost reduction. Product design being the first step in production, if cost reduction can be made at design stage, then it is likely that the benefits can be availed to the maximum.

There are two basic points that should be kept in mind while effecting cost reduction in product design :

(*a*) The product should perform all the functions for which it is intended, and
(*b*) The product should retain its 'esteem' or 'aesthetic' value. This is in the case of many products which have the shape or other characteristic which pleases the eye.

Improvement in product design may result in cost reduction as illustrated below :

(*i*) *Material cost*—Change in design of the product may result in saving in material cost. Economical substitution for existing material may also be considered. For example, in manufacturing kitchen utensils, brass may be substituted by cheaper alloys. In curtain rings, metal may be substituted by plastic.
(*ii*) *Labour cost*— Improvement in design may result in reduced operating time.
(*iii*) *Factory overhead*—Reduced operating time not only helps in saving in labour cost but also in factory overhead.
(*iv*) *Packing and transportation*—Compact design of a product results in reduced cost of packing and transportation.
(*v*) Cost of tools, jigs and fixtures can be reduced through design improvement.

2. Organisation. Cost reduction may also be achieved by improving factory organisation in the form of clear-cut lines of authority and responsibility, well-defined channels of communications, co-ordination and co-operation between various executives, etc.

3. Production. A cost reduction programme should make a study of sequence of operations to find out the best one, to use the most suitable machines for the work, to use jigs and fixtures to reduce operating time, to reduce idle time, to reduce scrap by the use of better quality tools, to provide better working conditions conductive to efficiency, etc.

4. Administration. Items under this head include savings effected by modifying the range of cash discounts to customers, introducing mechanical and electronic aids to office routine, modifying internal and external communication system, etc.

5. Marketing. In this function, costs can be reduced by revising the methods of remuneration of salesmen, re-arrange territorial responsibilities of sales representatives, modifying current methods of

advertising, improving product design and production quality so as to reduce after sales service, economising channels of distribution, improving packing, etc.

6. Finance. A cost reduction programme should aim at securing capital at economical cost, employing capital to give maximum return and eliminating over and under capitalisation and wasteful use of capital, etc.

Tools and Techniques of Cost Reduction and Cost Control

Various tools and technique used for cost reduction include the following :

1. Standard costing
2. Budgetary control
3. Inventory control
4. Production planning and control
5. Standardisation and simplification
6. Operational research and statistical techniques
7. Value analysis
8. Automation
9. Design improvement
10. Market research
11. Job evaluation and merit rating
12. Work study
13. Organisation and methods study
14. Quality control.

COST MANAGEMENT

The present day business environment is significantly different from that of the yesteryears. The rapid pace of change is because of factors such as — globalisation of markets; spectacular advances in information and manufacturing technology, deregulation, increasing emphasis on total quality management, etc. The emphasis on quality of products and productivity requires new measures of control. Cost accounting information plays a very important role in determining the appropriate strategic direction for the organisation and effective management. Of course, cost accounting methods and techniques are important but equally important is to understand how to use them for effective decision making. Cost management addresses these changing requirements. In the changed business scenario, the managers have turned towards cost management to find ways and means to continuously reduce costs to improve product/service quality and at the same time maintain profitability.

Definition

Cost management is a new entrant in the terminology of management and is widely used these days in the business world. Somehow, no uniform definition of this term has developed so far.

In the words of Horngren, cost management is used *"to describe the approaches and activities of managers in the short term and long term planning and control decisions that increase value for customers and lower costs of products and services."*

According to Hansen and Moven, *"Cost management identifies, collects, measures, classifies and reports information that is useful to managers in costing (determining what something costs), planning, controlling and decision making."*

It may thus be said that cost management is the practical application and use of cost accounting methods and techniques by the management to improve business performance. Information provided by

cost accounting system helps managers make decisions regarding the amount and kind of materials used, changes of product designs, changes in plant processes, etc.

Advantages

The following are the advantages of cost management:

1. Cost management helps in cost based strategic planning. It provides critical information that manager needs to develop and implement successful strategies. In taking a strategic emphasis, cost management looks to long term competitive success of the firm.
2. Cost management helps in improving factoral productivity and profit margin.
3. Cost management ensures that planning and control of costs are directly linked with revenues and profit planning. For example, the effect of additional cost incurred on sales promotion and product modification on the increase in revenue and profit is studied.
4. Cost management methods and practices are used to help the firm in gaining success.
5. It improves understanding of processes and activities. The same cost may be analysed in different ways to study its relationship with the activity. This helps in more effective planning.

Cost management is an integral part of the general management, planning and monitoring mechanism and it is not practised in isolation. It can be effectively used by both production and service organisations. Use of cost management can significantly benefit many organisations by increasing resource productivity and margins and facilitating effective management of costs.

Cost Management, Cost Accounting and Management Accounting

Cost management has a much broader focus and encompasses both cost accounting and management accounting. Cost accounting is concerned with ascertainment of costs of products/services. But cost management is not only concerned with how much something costs but also with the factors that drive costs such as quality of the product, productivity of factors, cycle time, etc. Thus cost management needs a deeper understanding of a firm's cost structure. The cost information provided by cost accounting plays an important support role for management in planning, controlling and decision making.

Management accounting is concerned with not only cost information but also with non-cost and other financial information that can be used for planning, controlling and decision making. The overall objective of management accounting to make sure that organisation makes effective use of resources so that business objectives may be achieved.

KEY TERMS

Management Accounting: It is concerned with accounting information that is useful to management.
Management Accountant: He is an official who analyses and interprets accounting information to meet the informational needs of management.
Controller: In USA the management accountant is also called controller or financial controller.
Cost Control: It is the achievement of predetermined targets of cost.
Cost Reduction: It is the achievement of real and permanent reduction in cost.
Cost Management: It is the practical application and use of cost accounting by the management to improve business performance

EXAMINATION QUESTIONS

Objective Type Questions

True and False ?

1. Management accounting is a branch of accounting that produces information for managers within an organisation.
2. Management accounting is based on double entry system.
3. Management accountant is also called controller.
4. Cost accounting is a part of management accounting.
5. Management accountant must be a qualified Chartered Accountant or Management Accountant from the Institute of Chartered Accountants of India.
6. Small firms may find it difficult to afford a system of management accounting which is quite costly.
7. Management accounting system cannot be installed without a proper system of cost accounting.
8. Management accounting is a branch of financial accounting.
9. Ratio analysis and funds flow statements are part of management accounting.
10. Main emphasis of management accounting is on cost ascertainment and cost control for maximisation of profit.

[**Ans.** 1. True; 2. False; 3. True; 4. True; 5. False; 6. True; 7. True; 8. False; 9. True; 10. False.]

Essay Type Questions

1. Define management accounting and explain its objectives. *(B.Com Hons Delhi)*
2. What are the functions of management accounting ?
3. What is managment accounting? In what respects it is different from financial accounting? *(B.Com Hons Delhi)*
4. In what respects cost accounting is different from management accounting ?
5. Discuss the role of management accountant in a modern organisation.
6. Explain the nature and scope of management accounting.
7. Discuss management accounting as an effective tool of financial control.
8. "There is an intimate relationship between management accounting and finance functions." Elucidate.
9. "Management accounting is concerned with accounting information which is useful to management." Explain.
10. What is cost reduction? Give examples. *(B.Com Hons., Delhi)*
11. Distinguish between cost control and cost reduction. *(B.Com.Hons Delhi; C.A., P.E.-II)*
12. What is meant by cost control and cost reduction? *(B.Com., Bangalore)*
13. "Product design provides for greatest scope for cost reduction". Discuss. *(B.Com Hons Delhi)*
14. Write a note on cost management. *(B.Com Hons Delhi)*
15. What is meant by cost management ? Discuss its advantages.
16. Mention a few areas in which cost reduction is possible in a large manufacturing concern.

CHAPTER 2

BUDGETING AND BUDGETARY CONTROL

CHAPTER OUTLINE

Introduction; Meaning and definition of budget and budgetary control; Objectives; Advantages; Limitations; Essentials of effective budgeting; Budget admmistration; Functional budgets; Master budget; Fixed and flexible budgets; Revision of budgets; Budget reports; Zero base budget; Performance budgeting; Problems and solutions; Examination questions.

Introduction

Business budgeting is the most widely used and highest rated management tool of planning and control. *Planning* is the key to good management as it involves looking systematically at the future. Business budgets help managers in developing financial plan to guide them in allocating their resources over a specific future period. *Control* is the process of measuring and correcting actual performance to ensure that plans for implementing the chosen course of action are carried out.

Meaning and Definition of Budget

Budget refers to a plan relating to a definite future period of time expressed in monetary and/or quantitative terms. In relation to business, a budget is a formal expression of the expected incomes and expenditures for a definite future period. The Chartered Institute of Management Accountants (C.I.M.A.) London, has defined a budget as *"a financial and/or quantitative statement, prepared prior to a defined period of time, of the policy to be pursued during that period for the purpose of attaining a given objective."* It may include income, expenditure and employment of capital.

In this words of Gorden Shillinglaw, a business budget is *"a pre-determined detailed plan of action, developed and distributed as a guide to current operations and as a partial basis for subsequent evaluation of performance."*

According to Brown and Howard, *"A budget is a pre-determined statement of management policy during a given period which provides a standard for comparison with the results actually achieved."*

Characteristics – Budgets have the following characteristics :

(*a*) A budget is primarily a planning device but it also serves as a basis for performance evaluation and control.
(*b*) A budget is prepared either in money terms or in quantitative terms or in both.
(*c*) A budget is prepared for a definite future period.
(*d*) Purpose of a budget is to implement the policies formulated by management for attaining the given objectives.

Budgeting

The act of preparing budgets is called budgeting. In the words of J. Batty, *"the entire process of preparing the budgets is known as budgeting."*

Meaning and Definition of Budgetary Control

Budgetary control is a system of controlling costs through preparation of budgets. Budgeting is thus only a part of the budgetary control. According to C.I.M.A., London, *"Budgetary control is the establishment of budgets relating to the responsibilities of executives of a policy and the continuous comparison of the actual with the budgeted results, either to secure by individual action the objective of the policy or to provide a basis for its revision."*

In the words of Brown and Howard, *"Budgetary control system is a system of controlling costs which includes the preparation of budgets, co-ordinating the departments and establisting responsibilities, comparing actual performance with the budgeted and acting upon results to achieve maximum profitability."*

Characteristics—The main characteristics of budgetary control are :

(*a*) *Establishment of budgets* for each function/department of the organisation.
(*b*) *Comparison* of actual performance with the budgets on a continuous basis.
(*c*) *Analysis of variations* of actual performance from that the budgeted performance to know the reasons thereof.
(*d*) Taking suitable *remedial action*, where necessary.
(*e*) *Revision of budgets* in view of changes in conditions.

The principles involved in budgeting have been likened to those followed by the captain of a ship. Before the voyage, he will plan his route, taking into account such factors as shipping hazards, tides and possible adverse weather forecasts. During the journey, he will record details of progress and frequently check actual progress with that planned. Though trying to keep to the plan, he may have to deviate from the plan if prevailing circumstances require it. On completion of the journey, he will compare the conditions he encountered with those he expected. The experience so gained will be used by him in planning similar voyages in the future. This simple analogy serves to illustrate the basic practice used in budgeting and budgetary control.

The technique of budgetary control is now widely used in the business world. Many businesses fail because of lack of efficient planning which could have revealed that the business should not have been started or that one should have been prepared to face serious dangers ahead.

Forecast and Budget

It is important to note carefully the distinction between forecast and a budget.

A forecast is a prediction of what may happen as a result of a given set of circumstances. It is an assessment of probable future events.

A budget, on the other hand, is a planned exercise to achieve a target. It is based on the pros and cons of a forecast. Forecasting thus precedes the preparation of budget.

Thus the main points of distinction between the two are thus :

1. Budgets relate to 'planned events', *i.e.*, policies and programmes to be pursued. Forecast is concerned with 'probable events', *i.e.*, events expected to happen under anticipated conditions.
2. Budget, being a formal business plan, can be prepared only by the anthorised management but forecast can be made by anybody.
3. Budget is a tool of control while the forecast is simply an anticipation of events.
4. Forecasting is a pre-requisite for budgeting while budgeting is not a pre- requisite for forecasting.
5. Budgets relate to economic activities of business, enterprises, government or others. Forecast may relate to economic as well as non economic activities, *e.g.*, weather forecast, stock market forecast, etc.

Objectives of Budgetary Control

The following are the main objectives of a budgetary control system.

1. Planning. A budget provides a detailed plan of action for a business over a definite period of time. Detailed plans are drawn up relating to production, sales, raw material requirements, labour needs, advertising and sales promotion performance, research and development activities, capital additions, etc. Planning helps in anticipating many problems long before they may arise and solutions can be sought through careful study. Thus most business emergencies can be avoided by planning. In brief, budgeting forces managements to think ahead, to anticipate and prepare for the situation.

2. Co-ordination. Budgeting aids managers in co-ordinating their efforts so that objectives of the organisation as a whole harmonise with the objectives of its divisions. Effective planning and organising contribute a lot in achieving co-ordination. There should be co-ordination in the budgets of various departments. For example, the budget of sales should be in co-ordination with the budget of production. Similarly, the production budget should be prepared in co-ordination with the purchase budget, and so on.

3. Communication. A budget is a communication device. The approved budget copies are distributed to all management personnel which provides not only adequate understanding and knowledge of the programmes and policies to be followed but also alerts about the restrictions to be adhered to.

It is not the budget itself that facilitates communication, but the vital information is communicated in the act of preparing budgets and participation of all responsible individuals in this act.

4. Motivation. A budget is a useful device for motivating managers to perform in line with the company objectives. If individuals have actively participated in the preparation of budgets, it acts as a strong motivating force to achieve the targets.

5. Control. Control is necessary to ensure that plans and objectives as laid down in the budgets are being achieved. Control, as applied to budgeting, is a systematised effort to keep the management informed of whether the planned performance is being achieved or not. For this purpose, a comparison is made between plans and actual performance. The difference between the two is reported to the management for taking corrective action.

6. Performance evaluation. A budget provides a useful means of informing managers how well they are performing in meeting targets they have previously helped to set. In many companies there is a practice of rewarding employees on the basis of their achieving the budget targets or promotion of a manager may be linked to his budget achievement record.

Advantages of Budgetary Control

Budgetary control provides the following advantages :

1. Budgeting compels managers to think ahead—to anticipate and prepare for changing conditions.
2. Budgeting co-ordinates the activities of various departments and functions of the business.
3. It increases production efficiency, eliminates waste and controls the costs.
4. It pinpoints efficiency or lack of it.
5. Budgetary control aims at maximisation of profits through careful planning and control
6. It provides a yardstick against which actual results can be compared.
7. It shows management where action is needed to remedy a situation.
8. It ensures that working capital is available for the efficient operation of the business.
9. It directs capital expenditure in the most profitable direction.
10. It instills into all levels of management a timely, careful and adequate consideration of all factors before reaching important decisions.
11. A budget motivates executives to attain the given goals.
12. Budgetary control system creates necessary conditions for the introduction of standard costing technique.
13. Budgeting also aids in obtaining bank credit.
14. A budgetary control system assists in delegation of authority and assignment of responsibility.
15. Budgeting creates cost consciousness and introduces an attitude of mind in which waste and efficiency cannot thrive.

Limitations of Budgetary Control

The list of advantages given above is impressive, but a budget is not a cure all for organisation ills. Budgetary control system suffers from certain limitations and those using the system should be fully aware of them.

The main limitations are :

1. The budget plan is based on estimates. Budgets are based on forecasts and forecasting cannot be an exact science. Absolute accuracy, therefore, is not possible in forecasting and budgeting. The strength or weakness of the budgetary control system depends to a large extent, on the accuracy with which estimates are made. Thus, while using the system, the fact that budget is based on estimates must be kept in view.

2. Danger of rigidity. A budget programme must be dynamic and continuously deal with the changing business conditions. Budgets will lose much of their usefulness if they acquire rigidity and are not revised with the changing circumstances.

3. Budgeting is only a tool of management. Budgeting cannot take the place of management but is only a tool of management. "The budget should be regarded not as a master, but as a servant." Sometimes it is believed that introduction of a budget programme is alone sufficient to ensure its success. Execution of a budget will not occur automatically. It is necessary that the entire organisation must participate enthusiastically in the programme for the realisation of the budgetary goals.

4. Opposition from staff. Employees may not like to be evaluated and thus oppose introduction of budgetary control system. As such, inefficient managers may try to create difficulties in the way of introducing and operating this system.

5. Expensive technique. The installation and operation of a budgetary control system is a costly affair as it requires the employment of specialised staff and involves other expenditure which small concerns may find difficult to incur. However, it is essential that the cost of introducing and operating a budgetary control system should not exceed the benefits derived therefrom.

Essentials of Budgeting

1. Support of top management.
2. Participation by responsible executives.
3. Reasonable goals.
4. Clearly defined organisation.
5. Continuous budget education.
6. Adequate accounting system.
7. Constant vigilance.
8. Maximum profits.
9. Cost of the system.
10. Integration with standard costs.

ESSENTIALS OF EFFECTIVE BUDGETING

A budgetary control system can prove successful only when certain conditions and attitudes exist, absence of which will negate to a large extent the value of a budget system is any business. Such conditions and attitudes which are essential for effective budgeting are as follows :

1. Support of top management. If the budget system is to be successful, it must be fully supported by every member of management and the impetus and direction must come from the very top management. No control system can be effective unless the organisation is convinced that the top management considers the system to be important. Thus the top management must be committed to the budget idea as well as to the principles, policies and philosophy underlying the system.

2. Participation by responsible executives. Those entrusted with the performance of the budgets should participate in the process of setting the budget figures. This will ensure proper implementation of budget programmes.

3. Reasonable goals. The budget figures should be realistic and represent reasonably attainable goals. The responsible executives should agree that the budget goals are reasonable and attainable.

4. Clearly defined organisation. In order to derive maximum benefits from the budget system, well defined responsibility centres should be built up within the organisation. The controllable costs for each responsibility centres should be separately shown.

5. Continuous budget education. The best way to ensure the active interest of the responsible supervisors is continuous budget education in respect of objectives, potentials and techniques of budgeting. This may be accomplished through written manuals, meetings, etc. whereby preparation of budgets, actual results achieved etc., may be discussed.

6. Adequate accounting system. There is close relationship between budgeting and accounting. For the preparation of budgets, one has to depend on accounting department for reliable historical data which primarily forms the basis for many estimates. The accounting system should be so designed so as to set up accounts in terms of areas of managerial responsibility. In other words, responsibility accounting is essential for successful budgetary control.

7. Constant vigilance. Reports comparing budget and actual results should be promptly prepared and special attention focussed on significant exceptions—figures that are significantly different from those expected.

8. Maximum profits. The ultimate object of realising the maximum profit should always be kept uppermost.

9. Cost of the system. The budget system should not cost more than it is worth. Since, it is not practicable to calculate exactly what a budget system is worth, it only implies a caution against adding expensive refinements unless their value clearly justifies them.

10. Integration with standard costing system. Where standard costing system is also used, it should be completely integrated with the budget programme, in respect of both budget preparation and variance analysis.

BUDGET PROCESS

Budget proces may be defined as "the proces by which the management create, approve and implement budgets". It involves the following steps:

1. Creation of budget centres. A budget centre is a section of the organisation of an undertaking for which a separate budget is prepared. A budget centre may be a department or a part thereof. For examples, sales department may be a budget centre for which a sales budget is prepared. Budget centre must be clearly defined because a separate budget has to be set for each such centre with the help of the head of the department concerned. For example, in the preparation of purchase budget, the purchase manager has to be consulted.

2. Introduction of adequate accounting records. The accounting system should be so designed as to be able to record and analyse the information required. The budget procedures must also employ the same classification of revenues and expenses as the accounting department. Comparisons cannot be made if the classifications do not coincide. A chart of accounts corresponding with the budget centres should be maintained.

3. Preparation of an organisation chart. Proper organisation is essential for a successful budget system. An organisation chart should be prepared which clearly shows the plan of the organisation. Each member of management should know the exact scope of his authority and responsibility and his relationship to other members. For this purpose, copies of the organisation chart and written supplements should be distributed to all concerned.

The organisation chart will depend upon the nature and size of the company. A specimen of the organisation chart is given in Fig 2.1

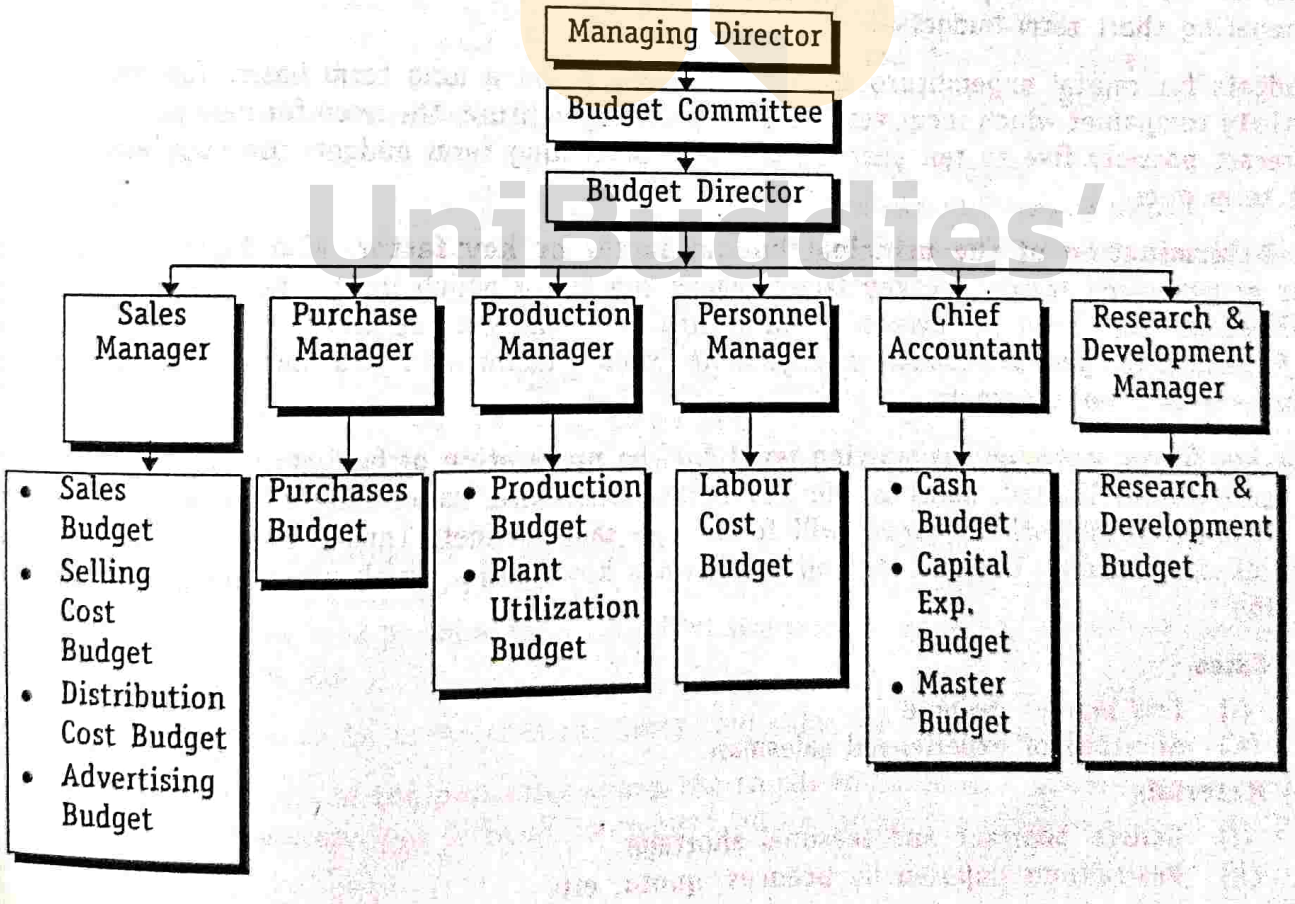

Fig 2.1 Organisation Chart for Budgetary Control.

4. Establishment of budget committee. In large concerns, the direction and execution of the budget is delegated to a budget committee which reports directly to the top management. The financial controller is usually appointed to serve as the budget director. He is incharge of preparing budget manual of instructions and accumulates the budget and actual figures for reporting. Other members of the budget committee usually comprise various heads of functional departments, like sales manager, purchase manager, production manager, chief accountant, etc. as shown in the above organisation chart. Each member prepares his own departmental budget(s) which are then considered by the committee for coordination.

5. Preparation of budget manual. A budget manual has been defined by C.I.M.A., London as *"a document which sets out the responsibilities for the persons engaged in the routine of and the forms and records required for budgetary control."* A budget manual is thus a statement of budget policies. It lays down the details of the organisational set up with duties and responsibilities of executives including the budget committee and budget director and the procedures and programmes to be followed for developing budgets for various activities.

6. Budget period. Budget period is a length of time for which a budget is prepared and operated. Budget periods vary between short term and long term and no specific period can be laid down for all budgets. It varies among concerns and industries for several factors.

A budget is usually prepared for one year which corresponds to the accounting year. It is then sub-divided into quarters and in turn each quarter is broken down into three separate months. When a business experiences seasonal fluctuations, the budget period may be fixed to cover one seasonal cycle. If the seasonal cycle covers say two or three years, a long term budget should be prepared to cover that period. The long period may then be broken down into smaller periods by preparing short term budgets.

Budgets for capital expenditure are usually prepared on a long term basis. For example, in electricity companies which incur very heavy capital expenditure, the need for new power stations is forecast possibly five to ten years in advance. Such long term budgets are supplemented by short term ones.

7. Determination of the principal budget factor or key factor. Also known as limiting factor or governing factor, the key factor means the factor which limits the size of output. It is defined as *"the factor the extent of whose influence must first be assessed in order to ensure that functional budgets are capable of fulfilment"* Such a factor is of vital importance and affects all budgets to a large extent.

The key factor serves as the starting point for the preparation of budgets. For instance, when sales potential is limited, sales is the key factor. Therefore, sales budget should be prepared first. Production and other budgets will follow the sales budget. Thus a key factor determines priorities in functional budgets. Among the various key factors which affect budgeting are the following :

(*a*) **Sales**

(*i*) Low market demand
(*ii*) Shortage of experienced salesman.

(*b*) **Materials**

(*i*) General shortage and seasonal shortage
(*ii*) Restrictions imposed by licences, quota, etc.

(c) **Labour**
- (i) General shortage
- (ii) Shortage of specialised labour in a particular process.

(d) **Plant**
- (i) Limited plant capacity
- (ii) Bottlenecks in certain key processes.

(e) **Management**
- (i) Shortage of experienced executives
- (ii) Paucity of know-how.

In this age of competition, most often, sales is the key factor in industry.

It is possible that more than one key factor is operating at the same time. Under such conditions, the relative impact of such factors is considered in budget preparation. Moreover, key factor is not necessarily a permanent factor. The management may be provided with opportunities to overcome the limitations imposed by key factors. For example, plant capacity can be increased by the installation of new and improved plant and machinery which may be financed by the issue of new shares.

FUNCTIONAL BUDGETS

A functional budget is one which relates to a particular function of the business, *e.g.*, Sales Budget, Production Budget, Purchase Budget, etc. These are components of master budget. Specific functional budgets to be prepared in a business vary from organisation to organisation. The common types of functional budgets for a manufacturing concern are discussed here in brief.

Types of Functional Budgets

1. Sales Budget.
2. Production Budget.
3. Production Cost Budget.
4. Raw Materials Budget.
5. Purchases Budget.
6. Labour Budget.
7. Production Overhead Budget.
8. Selling and Distribution Cost Budget.
9. Administration Cost Budget
10. Cash Budget.
11. Capital Expenditure Budget.

Sales Budget

In most companies, the sales budget is not only the most important but also the most difficult budget to prepare. The importance of this budget arises from the fact that if sales figure is incorrect, then practically all other budgets will be affected. The difficulties in the preparation of this budget arise because it is not easy to estimate consumer demand, particularly when a new product is introduced.

The sales budget is a statement of planned sales in terms of quantity and value. It forecasts what the company can reasonably expect to sell to its customers during the budget period. The sales budget can be prepared to show sales classified according to products, salesmen, customers, territories and periods, etc.

Factors: The factors to be considered in forecasting sales are the following:

1. Past sales. Analysis of the past sales shows the trends to date and any seasonal or cyclical fluctuations. It is, therefore, not difficult to suggest future trends from the analysis of the past sales.

2. Reports by salesmen. The salesman are in close touch with the market and thus, they may be required to prepare detailed estimates of sales that they are likely to make in their respective

areas during the budget period. The report of each salesman should be studied in the light of his past assessment and actual sales.

3. Company conditions. Any change in policies and methods of the company and their effects on sales should be considered. For example, additional spending on advertising, introduction of new channels of distributions, introduction of new products, etc. should all have some effect of a sales budget.

4. Business conditions. Any changes in economic conditions and that in related business activities and their effect on company sales should be considered. Information should be obtained about competing industries to assess the strength of competition and about the customer requirement to determine their demand.

5. Special conditions. In the preparation of sales forecast, any new external developments taking place should also be considered. For example, when an industry manufactures products for another industry, it will be necessary to analyse the trend of sales in that industry. A tyre manufacturer would estimate the sales of cars or scooters on which tyres are used.

6. Market analysis. Some companies depend upon market analysis and research to measure the potential demand for their products. Such an analysis reports on the state of the market, fashion trends, the type of products design required, activities of the competitors and other factors which may have a bearing on the sales of the company.

Production Budget

The production budget is a plan of production for the budget period. It is first drawn up in quantities of each product and when the remaining budgets have been compiled and cost of production calculated, then the quantities of production cost are translated into money terms, what in effect becomes a production cost budget.

The production budget is the initial step in budgeting manufacturing operations. In addition to production budget, there are three other budgets relating to manufacturing activities of a company. These are raw materials budget, labour budget and production overhead budget.

Production Cost Budget

This budget shows the estimated cost of production. The production budget (explained above) shows the quantities of production. These quantities of production are expressed in terms of cost in production cost budget. The cost of production is shown in detail in respect of material cost, labour cost and factory overhead. Thus Production Cost Budget is based upon Production Budget, Material Cost Budget, Labour Cost Budget and Factory Overhead Budget.

Illustration 2.1

The following information has been made available from the records of Precision Tools Ltd. for the six months of 2017 (and the sales of January 2018) in respect of product X;

(*i*) The units to be sold in different months are :

July 2017	1,100	November 2017	2,500
August 2017	1,100	December 2017	2,300
September 2017	1,700	January 2018	2,000
October 2017	1,900		

(*ii*) There will be no work-in-progress at the end of any month.

(*iii*) Finished units equal to half the sales of the next month will be in stock at the end of every month (including June 2017).

(*iv*) Budgeted production and production cost for the year ending 31st Dec., 2017 are thus:

Production (units)		22,000
Direct materials per unit	₹	10
Direct wages per unit	₹	4
Total factory overhead apportioned to production	₹	88,000

You are required to prepare :

(*a*) Production Budget for the six months of 2017, and

(*b*) Summarised Production Cost Budget for the same period.

(B.Com. Hons., Delhi)

Solution

Production Budget
for the six months ending Dec. 2017

	July Units	*Aug. Units*	*Sep. Units*	*Oct. Units*	*Nov. Units*	*Dec. Units*	*Total*
Estimated sales	1,100	1,100	1,700	1,900	2,500	2,300	
Add: Closing stock	550	850	950	1,250	1,150	1,000	
	1,650	1,950	2,650	3,150	3,650	3,300	
Less: Opening stock	550	550	850	950	1,250	1,150	
Production	1,100	1,400	1,800	2,200	2,400	2,150	11,050

Production Cost Budget
for the six months ending Dec. 2017

(Production: 11,050 units)

		₹
Direct materials	@ ₹ 10 for 11,050 units	1,10,500
Direct wages	@ ₹ 4 for 11,050 units	44,200
*Factory overhead	@ ₹ 4 for 11,050 units	44,200
Total Production Cost		1,98,900

*Factory overhead per unit = ₹ 88,000 ÷ 22,000 units = ₹ 4.

Raw Material Budget

This budget shows the estimated quantities of all the raw materials and components needed for production demanded by the production budget. Raw material budget serves the following purposes:

(*a*) It assists purchasing department in planning the purchases.
(*b*) It helps in the preparation of purchase budget.
(*c*) It provides data for raw material control.

It should be noted that raw material budget generally deals with only the direct materials. Indirect materials and supplies are included in the overhead cost budget.

Purchase Budget

Careful planning of purchases offers one of the most significant areas of cost saving in many companies. The purchase manager should be assigned the direct responsi-bility for preparing a detailed plan of purchases for the budget period and for submitting the plan in the form of a purchase budget.

The purchase budget provides details of the purchases which are planned to be made during the period to meet the needs of the business. It indicates:

(*a*) The quantities of each type of raw material and other items to be purchased;

(*b*) The timing of purchases;

(*c*) The estimated cost of material purchases.

The purchase budget differs from the raw material budget in that purchase budget specifies both quantities and rupee costs, whereas raw material budget is usually limited to quantities only. *Secondly*, purchase budget includes direct and indirect materials, finished goods for resale, services like electricity and gas, etc. while raw material budget includes only direct material requirements.

Illustration 2.2

The sales manager of Mahindra & Co. Ltd reports that next year he expects to sell 50,000 units of a certain product.

The production manager consults the storekeeper and casts his figures as follows: Two kinds of raw materials *A* and *B* are required for manufacturing the product. Each unit of the product requires 2 kg of *A* and 3 kg of *B*. The estimated opening balances at the commencement of the next year are—Finished Product, 10,000 units; *A*, 12,000 kg; *B* 15,000 kg. The desirable closing balances at the end of the next year are: Finished product, 14,000 units; *A*, 13,000 kg; *B*, 16,000 kg.

Draw up a Materials Purchases Budget for the next year. (*B.Com. Hons. Delhi Adapted*)

Solution

Estimated production quantity during the year is not given, it is calculated as under.

	Sales during the year	50,000 units
Add:	Desired stock at the end of next year	14,000 units
	Total	64,000 units
Less:	Expected stock at the beginning of the next year	10,000 units
	Estimated production	54,000 units

Purchase Budget for the period .....

	Item	*Material A kg*	*Material B kg*
	Consumption during the year :		
	A—54,000 units @ 2 kg per unit	1,08,000	—
	B—54,000 units @ 3 kg per unit	—	1,62,000
Add:	Desired stock at the end of next year	13,000	16,000
		1,21,000	1,78,000
Less:	Expected stock at the commencement of next year	12,000	15,000
	Quantities of materials to be purchased	1,09,000	1,63,000

Labour Budget

Labour cost is classified into direct and indirect. Some companies prepare a labour budget that includes both direct and indirect labour, while others include only direct labour cost and include indirect labour in the overhead cost budget.

The labour budget represents the forecast of labour requirements to meet the demands of the company during the budget period. This budget must be linked with production budget and production cost budget. The method of preparing labour budget is like this. The standard direct labour hours of each grade of labour required for each unit of output and standard wage rate for each grade of labour are ascertained. Multiplication of units of finished goods to be produced by the labour cost per unit gives the direct labour cost. The indirect labour is normally a fixed amount, so should be easy to calculate in total for the period.

Production Overhead Budget

After budgeting of material and labour cost, next logical step is to prepare a budget for production overheads. The production overhead budget represents the forecast of all the production overhead (fixed, variable and semi-variable) to be incurred during the budget period. The fact that overheads include many dissimilar types of expenses creates considerable problems in:

(*a*) The allocation of production overheads to products manufactured, and
(*b*) Control of production overheads.

The production overhead budget involves the preparation of overhead budgets for each department of the factory as it is desirable to have estimates of manufacturing overheads prepared by those individuals who have the responsibility for incurring them.

Selling and Distribution Cost Budget

This is closely related to sales budget and represents the forecast of all costs incurred in selling and distributing the company's products during the budget period. As a general rule, the sales budget and the selling and distribution cost budgets are prepared simultaneously, since each has a definite impact on the other.

The sales manager is responsible for selling and distribution cost budget. He prepares this budget with the help of heads of sub-divisions of the sales department. Some companies prepare a separate advertising budget, particularly when spendings on advertising are quite heavy.

Administration Cost Budget

This budget represents forecast of all administration expenses like directors' fees, managing director's salary, office lighting, heating and air conditioning, etc. Most of these expenses are fixed, so should not be too difficult to forecast.

Capital Expenditure Budget

This budget represents the expenditure on all fixed assets during the budget period. It includes such items as new buildings, machinery, land and intangible items like patents, etc.

Special Features: The capital expenditure budget has certain characteristic features which distinguish it from other functional budgets. These are :

(*a*) Capital expenditure budget deals with items not directly related to profit and loss account. Expenses related to capital expenditure such as depreciation, repairs and maintenance, etc. are, however, corelated to this budget and they are included in overhead budgets.

(*b*) Capital expenditure is frequently planned a number of year in advance, perhaps five to ten years, in which case it is broken down into convenient periods like years or months. As compared to this, other functional budgets are normally prepared for a shorter period, say, one year.

(*c*) This budget involves large amount of expenditure which needs top management approval. The capital expenditure budget is, therefore, subject to a strict management control.

Cash Budget

The cash budget is one of the most important and one of the last to be prepared. It is a detailed estimate of cash receipts from all sources and cash payments for all purposes and the resultant cash balances during the budget period. It makes certain that the business has sufficient cash available to meet its needs as and when these arise. It is a device for coordinating and controlling the financial side of the business to ensure solvency and provide a basis for planning and financing required to cover up any deficiency in cash. Cash budget thus plays an important role in the financial management of a business undertaking.

Purposes: The main purposes of cash budget are outlined below :

(*a*) It ensures that sufficient cash is available when required.
(*b*) It indicates cash excesses and shortages so that action may be taken in time to invest any excess cash or to borrow funds to meet any shortages.
(*c*) It establishes a sound basis for credit.
(*d*) It shows whether capital expenditure may be financed internally.
(*e*) It establishes a sound basis for control of cash position.

Receipts and Payments Method is used prepering cash budget. The cash budget begins with the opening balance of cash in hand and at bank. To this will be added the cash receipts from various sources and from this will be deducted all payments of cash, whether on capital or revenue account. The resultant figure is closing cash balance.

Cash receipts in most situations arise from cash sales, collections from debtors, interest on investments and loans, sale of capital assets and miscellaneous sources. In the case of credit sales, adjustment should be made for the time lag between the point of sale and realisation of cash.

Cash payments are made for raw material purchases, direct labour, out of pocket expenses, capital expenditure projects, dividends. etc. The period of credit appropriate to the payment concerned should be taken into account.

Illustration 2.3

A company is expecting to have ₹ 25,000 cash in hand on 1st April 2017 and it requires you to prepare cash budget for the three months April to June 2017. The following information is supplied to you:

	Sales ₹	*Purchase* ₹	*Wages* ₹	*Expenses* ₹
February	70,000	40,000	8,000	6,000
March	80,000	50,000	8,000	7,000
April	92,000	52,000	9,000	7,000
May	1,00,000	60,000	10,000	8,000
June	1,20,000	55,000	12,000	9,000

Other information :

(*a*) Period of credit allowed by suppliers is two months;

(*b*) 25% of sale is for cash and the period of credit allowed to customers for credit sale is one month;

(*c*) Delay in payment of wages and expenses one month;

(*d*) Income tax ₹ 25,000 is to be paid in June 2017. (*B. Com., Madurai*)

Solution

Cash Budget for three months ending June 2017

	April ₹	*May* ₹	*June* ₹	*Total* ₹
Opening balance	25,000	53,000	81,000	25,000
Receipts :				
Cash sales	23,000	25,000	30,000	78,000
Debtors	60,000	69,000	75,000	2,04,000
Total	83,000	94,000	1,05,000	2,82,000
Payments:				
Creditors	40,000	50,000	52,000	1,42,000
Wages	8,000	9,000	10,000	27,000
Expenses	7,000	7,000	8,000	22,000
Income tax	—	—	25,000	25,000
Total	55,000	66,000	95,000	2,16,000
Closing balance	53,000	81,000	91000	91,000

MASTER BUDGET

When all the functional budgets have been prepared, these are summarised into what is known as a master budget. Thus a master budget is a consolidated summary of all the functional budgets. According to C.I.M.A., London, *"master budget is a summary budget incorporating its component functional budgets and which is finally approved, adopted and employed."*

A master budget has two parts (*i*) *operating budget, i.e.,* budgeted profit and loss account, and (*ii*) *financial budget, i.e.,* budgeted balance sheet. Thus, a projected profit and loss account and a balance sheet together constitute a master budget.

The master budget is prepared by the budget director (or budget officer) and is presented to the budget committee for approval. If approved, it is submitted to the Board of Directors for final approval. The Board may make certain amendments/alterations before it is finally approved.

FIXED AND FLEXIBLE BUDGETS

Based on level of activity or capacity utilisation, budgets are classified into fixed budget and flexible budget.

Fixed Budget

A fixed budget is one which is prepared keeping in mind one level of output. It is defined as a budget *"which is designed to remain unchanged irrespective of the level of activity attained."*

*If actual output differs from budgeted level of output, variances will arise. Fixed budget is prepared on the assumption that output and sales can be estimated with a fair degree of accuracy. This means that in those situations where sales and output cannot be accurately estimated, fixed budget does not suit.

Flexible Budget

In contrast to a fixed budget, a flexible budget is one *"which is designed to change in relation to the level of activity attained."** The underlying principle of flexible budget is that a budget is of little use unless cost and revenue are related to the actual volume of production. Flexible budgeting has been developed with the objective of changing the budget figures to correspond with the actual output achieved. Thus a budget might be prepared for various levels of activity, say, 70%, 80%, 90% and 100% capacity utilisation. Then whatever the level of output actually reached, it can be compared with an appropriate level.

Flexible budgets are prepared in those companies where it is extremely difficult to forecast output and sales with accuracy. Such a situation may arise in the following cases.

1. Where nature of business is such that sales are difficult to predict, *e.g.*, demand for luxury goods is quite unpredictable.
2. Where sales are affected by weather conditions, *e.g.*, soft drink industry, woollen garments, etc.
3. Where sales are affected by changes in fashion, *e.g.*, readymade garments.
4. Where company frequently introduces new products.
5. Where large part of output is intended for export.

Uses of Flexible Budgets The figures in flexible budgets are adaptable to any given set of operating conditions. It is, therefore, more realistic than a fixed budget which is true only in one set of operating conditions.

Flexible budgets are also useful from control point of view. Actual performance of an executive should be compared with what he should have achieved in the actual circumstances and not with what he should have achieved under quite different circumstances.

In brief, flexible budgets are more realistic, practical and useful. Fixed budgets, on the other hand, have a limited application and are suited only for items like fixed costs.

Distinction between Fixed and Flexible Budgets

The main points of distinction between the two are as follows :

1. Fixed budget assumes static business conditions whereas flexible budget is based on the assumption of changing business conditions.
2. Fixed budget is prepared for only one level of activity but flexible budgets may be prepared for different capacity levels or for any level of activity.
3. Fixed budget figures are not changed when actual level of activity changes. But in flexible budgets, the figures are adjusted according to the actual level of activity attained.
4. When actual level of activity differs from budgeted level of activity, then in fixed budgets meaningful comparison between actual and budget figures is not possible. But in flexible budgets, such comparison are quite realistic.

* CIMA, London terminology.

5. Under changing business environments, fixed budgets have very limited use for control. But flexible budgets are very useful for cost control and performance evaluation under changing business environments.

Preparation of Flexible Budgets

The preparation of flexible budgets necessitates the analysis of all costs into fixed and variable components. This analysis, of course, not peculiar to flexible budgeting, is more important in flexible budgeting than in fixed budgeting. This is so because in flexible budgeting, varying levels of output are considered and each class of overhead will be different for each level. In flexible budgeting, a series of budgets are prepared for every major level of activity so that whatever that actual level of output, it can be compared with appropriate budget or can be interpolated between budgets of the activity levels on either side. For example, budgets may be prepared for, say, 60%, 70%, 80%, 90% and 100% levels of activity. If the actual level of activity is 85%, then the budget allowance for 85% activity should be computed.

While computing fixed cost at various levels, it is to be noted that fixed cost in total amount remains unchanged at various levels of activity. However, fixed cost per unit decreases when level of output increases and vice versa, *i.e.*, fixed cost per unit increases when level of activity decreases.

Regarding the behaviour of variable costs, it is important to note that total variable cost increases in proportion to increase in the level of activity and vice versa. However, variable cost per unit does not change with the change in level of activity.

Semi-variable cost should be separated into fixed and variable components. Fixed component of the semi-variable cost will not change between levels but variable part of the semi-variable cost will change in the proportion of level of activity. This is explained in the following Illustrations.

Illustration 2.4

Draw up a flexible budget for overhead expenses on the basis of the following data and determine the overhead rates at 70%, 80% and 90% plant capacity.

	At 80% capacity ₹
Variable overheads:	
Indirect labour	12,000
Stores including spares	4,000
Semi-variable overheads :	
Power (30% fixed, 70% variable)	20,000
Repairs and maintenance (60% fixed, 40% variable)	2,000
Fixed overheads :	
Depreciation	11,000
Insurance	3,000
Salaries	10,000
Total overheads	62,000
Estimated direct labour hours	1,24,000 hrs.

(*B.Com., Madurai*)

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Solution

Flexible Budget *for the period .....*

	At 70% capacity	*At 80% capacity*	*At 90% capacity*
	₹	₹	₹
Variable overheads:			
Indirect labour	10,500	12,000	13,500
Stores including spares	3,500	4,000	4,500
Semi-Variable overheads:			
Power : Fixed	6,000	6,000	6,000
Variable	12,250	14,000	15,750
Repairs and Maintenance : Fixed	1,200	1,200	1,200
Variable	700	800	900
Fixed overheads:			
Depreciation	11,000	11,000	11,000
Insurance	3,000	3,000	3,000
Salaries	10,000	10,000	10,000
(A) Total overhead	58,150	62,000	65,850
(B) Estimated direct labour hours	1,08,500	1,24,000	1,39,500
Direct labour hour rate (A ÷ B)	₹ 0.536	0.500	0.472

Working Notes :

1. Indirect labour cost at 70% = $12,000 \times \frac{70}{80}$ = ₹ 10,500

   at 90% = $12,000 \times \frac{90}{80}$ = ₹ 13,500

   Similar calculation for other variable item, *i.e.*, stores.

2. Power – Fixed = ₹6,000, Variable = ₹ 14,000.

   Variable power at 70% = $14,000 \times \frac{70}{80}$ = ₹ 12,250

   at 90% = $14,000 \times \frac{90}{80}$ = ₹ 15,750

   Similar calculation for repairs and maintenance

3. Direct labour hours at 70% = $1,24,000 \times \frac{70}{80}$ = 1,08,500

   at 90% = $1,24,000 \times \frac{90}{80}$ = 1,39,500

Illustrations 2.5

Prepare a flexible budget for production at 80 per cent and 100 per cent activity on the basis of the following information :

Production at 50% capacity	5,000 units
Raw materials	₹ 80 per unit
Direct labour	₹ 50 per unit
Direct Expenses	₹ 15 per unit

Factory Expenses ₹ 50,000 (50% fixed)
Administration expenses ₹ 60,000 (60% variable). *(B.Com. Bangalore)*

Solution

Flexible Budget for the period.....

Cost	80% Capacity 8,000 units		100% Capacity 10,000 units	
	Per unit ₹	Total ₹	Per unit ₹	Total ₹
Raw materials	80.00	6,40,000	80.00	8,00,000
Direct labour	50.00	4,00,000	50.00	5,00,000
Direct expenses	15.00	1,20,000	15.00	1,50,000
Prime cost	145.00	11,60,000	145.00	14,50,000
Factory expenses :				
Variable	5.00	40,000	5.00	50,000
Fixed	3.125	25,000	2.50	25,000
Works cost	153.125	12,25,000	152.50	15,25,000
Administration expenses :				
Variable	7.20	57,600	7.20	72,000
Fixed	3.00	24,000	2.40	24,000
Total cost	163 .325	13,06,600	162.10	16,21,000

In flexible budgets, the following important points should be noted :

1. Total fixed costs for each level remains unchanged.
2. Per unit fixed cost decreases when level of output increases and vice versa.
3. Total variable cost increases in proportion to increase in the level of output and.
4. Per unit variable cost remains unchanged at each level.

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REVISION OF BUDGETS

Sometimes the original budget prepared may have to be revised due to one or more of the following factors.

1. Changes in management policies and other internal factors like change in the capacity utilisation or addition to the production capacity, etc.
2. Unforeseen changes in uncontrollable or external factors like change in market prices of materials and other inputs, changes in fashions and consumer tastes, etc.
3. Errors committed in the preparation of original budget.

While preparing a revised budget, changes in all the factors requiring consideration should be taken into account. The method of preparing a revised budget may be similar to preparing a flexible budget so long as it pertains to changes in level of output or capacity utilisation.

Illustration 2.6

A company produces two products and budgets at 60% level of activity for the year 2017. It gives the following information :

	Product A	*Product B*
Raw material cost per unit	₹ 7.50	3.50
Direct wages per unit	₹ 4.00	3.00
Variable overhead per unit	₹ 2.00	1.50
Fixed overhead per unit	₹ 6.00	4.50
Selling price per unit	₹ 20.00	15.00
Production and sales (units)	4,000	6,000

The managing director is not satisfied with the budgeted results as stated above and wants to improve the performance. The managing director proposed that the sales quantities of products A and B could be increased by 50% provided the selling price was reduced by 5% in the case of product A and 10% in the case of product B. The price reduction should be made applicable to the entire quantity of sales of each of the two products.

You are required to present the overall profitability under the original budget and revised budget after taking the increased sales into consideration. *(C.A., Inter)*

Solution

Original and Revised Budget
for the year 2017

	Original Budget			*Revised Budget*		
	A	*B*	*Total*	*A*	*B*	*Total*
Sales (units)	4,000	6,000		6,000	9,000	
	₹	₹	₹	₹	₹	₹
(A) Sales (value)	80,000	90,000	1,70,000	1,14,000	1,21,500	2,35,500
Costs :						
Raw material	30,000	21,000	51,000	45,000	31,000	76,500
Labour	16,000	18,000	34,000	24,000	27,000	51,000
Variable overhead	8,000	9,000	17,000	12,000	13,500	25,500
Fixed overhead	24,000	27,000	51,000	24,000	27,000	51,000
(A) Total cost	78,000	75,000	1,53,000	1,05,000	99,000	2,04,000
Profit (A + B)	2,000	15,000	17,000	9,000	22,500	31,500

Working Note : Revised sales figures are computed as follows :

		A	B
	Selling price per unit	₹ 20	15
	Less : 5% and 10%	₹ 1	1.50
		₹ 19	13.50
Sales value	A = 6,000 units × ₹ 19	= ₹ 1,14,000	
	B = 9,000 units × ₹ 13.50	= ₹ 1,21,500	

UniBuddies

ZERO BASE BUDGETING (ZBB)

ZBB is a recent development in the area of management control system and is steadily gaining importance in the business world. Before preparing a budget, a base is determined from which the budget process begins. Quite often current year's budget is taken as the base or the starting point for preparing the next year's budget. The figures in the base are changed as per the plan for the next year. This approach of preparing a budget is called *incremental budgeting* since the budget process is concerned mainly with the increases or changes in operations that are likely to occur during the budget period. For example, sales of the current year's budget may be taken as the base and next year's budget for sales will be current year's sales plus an allowance for price increases and expected changes in sales volumes. The main drawback of this approach is that it perpetuates the past inefficiencies.

Zero base budgeting (ZBB) is an alternative to incremental budgeting. ZBB was introduced at Texas Instruments in USA in 1969 by Peter Phyrr, who is known as the father of ZBB. It is not based on incremental approach and previous year's figures are not taken as the base for preparing next year's budget. Instead, the budget figures are developed with zero as the base, which means that a budget will be prepared as if it is being prepared for a new company for the first time.

Peter Phyrr has defined ZBB as *"a planning and budgeting process which requires each manager to justify his entire budget request in detail from scratch (hence zero base). Each manager states why he should spend any money at all. This approach requires that all activities be identified as decision packages which will be evaluated by systematic analysis ranked in order of importance."*

According to C.I.M.A., London, ZBB is defined as *"a method of budgeting whereby all activities are revaluated each time a budget is set. Discrete levels of each activity are valued and a combination chosen to match funds available."*

In simple words, ZBB is a system whereby each budget item, regardless of whether it is new or existing, must be justified in its entirety each time a new budget is prepared. It is a formalised system of budgeting for the activities of an enterprise as if each activity were being performed for the first time, *i.e.*, from zero base.

The novel part of the ZBB is the requirement that the budgeting process starts at zero with all expenditures to be completely justified. This contrasts with the usual approach in which a certain level of expenditure is allowed as a starting point and the budgeting process focuses on requests for incremental expenditures.

Main Features of Zero Base Budgeting (ZBB)

The main features of ZBB are as under :

1. All budget items, both old and newly proposed, are considered totally afresh.
2. Amount to be spent on each budget item is to be totally justified.
3. A detailed cost benefit analysis of each budget programme is undertaken and each programme has to compete for scarce resources.
4. Departmental objectives are linked to corporate goals.
5. The main stress in not on *'how much'* a department will spend but on *'why'* it needs to spend.
6. Managers at all levels participate in ZBB process and they have corresponding accountabilities.

ZBB is now-a-days widely used. In fact, when Jimmy Carter became the President of USA, he directed that all federal government agencies adopt ZBB. On a review of literature on the use of

ZBB, it is found that in many organisations, ZBB has led to a considerable improvement in the budget process. But at the same time, in many organisations it has not proved successful.

Advantages: The main advantages of ZBB are :

1. In ZBB, all activities included in the budget are justified on cost benefit considerations which promote more effective allocation of resources.
2. ZBB discards the attitude of accepting the current position in favour of an attitude of questioning and challenging each item of budget.
3. In the course of ZBB process, inefficient and loss making operations are identified and may be removed.
4. It adds psychological push to employees to avoid wasteful expenditure.
5. Deliberately inflated budget requests get automatically weeded out in the ZBB process.

Disadvantages: Despite being a useful technique, ZBB suffers from the following disadvantages:

1. ZBB leads to an enormous increase in paper work and results in high cost of preparing budgets every year.
2. Managers may resist new ideas and changes. They may feel threatened by ZBB because all expenditures are questioned and need to be justified.
3. In ZBB, there is danger of emphasising short-term gains at the expense of long-term benefits.
4. It has a tendency to regard any activity not foreseen and sanctioned in the most recent ZBB as illegitimate.
5. For introducing ZBB, managers need to be given proper training and education regarding this new concept, its pros and cons and implementation.

PROGRAM AND PERFORMANCE BUDGET

Performance budget is also a recent development which tries to overcome the limitations of traditional budgeting. In traditional system of budgeting as used in business enterprises and government departments, the main defect is that the control of performance in terms of physical units and the related costs is not achieved. This is because in such budgeting, money concept is given more importance. Performance budgeting is a relatively new concept which focuses on functions, programmes and activities.

In other words, in case of traditional budgeting, both input and output are mostly measured in monetary unit while performance budgeting lays emphasis on achievement of physical targets. Performance budgets are established in such a manner that each item of expenditure related to a specific responsibility centre is closely linked with the performance of that centre. Thus performance budgeting lays stress on activities and programmes. It tries to answer questions like—What is to be achieved?, How is it to be achieved?, When is it to be achieved?, etc.

The Government of India has now decided to introduce performance budgeting in all its departments in a phased manner. An example of performance budgeting in government system of accounting may be that generally expenditure is classified under the heads like pay and allowances, transport, repairs and maintenance, etc. In performance budgeting, the classification of expenditure may be setting up of a steel mill, construction of a railway station, computerisation of railway booking system, purchase of an aircraft carrier, etc. and other physical targets. When work on these activities is started, funds are obtained against these physical targets. Reports are then prepared for any under-spending or over-spending which are then analysed for corrective action to be taken.

Performance budgeting is sometimes called Programme Budgeting or Planning, Programme and Budget System (PPBS).

Steps in Performance Budgeting

1. **Establishment of responsibility centre.** First of all, responsibility centres are established. A responsibility centre is a segment of an organisation where an individual manager is held responsible for the performance of the segment.

2. **Establishment of performance targets.** For each responsibility centre, targets are set in terms of physical performance to be achieved. For example, for sales department, which is a responsibility centre, targets may be set in terms of number of units to be sold during the budget period. For production department, the target would then be the number of units to be produced.

3. **Estimating financial requirements.** In this step, the financial support needed to achieve the physical targets is estimated. In other words, the amount of expenditure involved under various heads to meet the physical performance is forecasted.

4. **Comparison of actual with budgeted performance.** This is a usual step in budgetary control to evaluate the actual performance.

5. **Reporting and action.** Variances from budgeted performance are analysed and reported for corrective action to be taken.

PROBLEMS AND SOLUTIONS

Problem 2.1

Prepare flexible budget for the overheads of Damyanti Ltd. from the following data and ascertain the overhead rates based on direct labour hrs. at 50%, 60% and 70% capacity :

	At 60% capacity
Variable overheads :	
Indirect material	₹ 6,000
Indirect labour	₹ 18,000
Semi-variable overheads :	
Electricity (40% fixed, 60% variable)	₹ 30,000
Repair (80% fixed, 20% variable)	₹ 3,000
Fixed overheads :	
Depreciation	₹ 16,500
Insurance	₹ 4,500
Salaries	₹ 15,000

Estimated direct labour hours 1,86,000 hrs. *(B.Com. Hons. Delhi)*

Solution

Flexible Budget *for the period.....*

	50% ₹	60% ₹	70% ₹
Variable Overhead			
Indirect materials	5,000	6,000	7,000
Indirect labour	15,000	18,000	21,000
Semi Variable Overhead			
Electricity— Fixed	12,000	12,000	12,000

— Variable	15,000	18,000	21,000
Repairs — Fixed	2,400	2,400	2,400
— Variable	500	600	700
Fixed Overhead			
Depreciation	16,500	16,500	16,500
Insurance	4,500	4,500	4,500
Salaries	15,000	15,000	15,000
Total Overhead (A)	85,900	93,000	1,00,100
Estimated Direct Labour Hours (B)	1,55,000*	1,86,000	2,17,000*
Direct Labour Hour Rate (A ÷ B)	0.554	0.500	0.461

***Working Note**

1. **Direct labour hours at 50% = 1,86,000 × $\frac{50\%}{60\%}$ = 1,55,000 hrs.**

at 70% = 1,86,000 × $\frac{70\%}{60\%}$ = 2,17,000 hrs.

Problem 2.2

The following data are available in a manufacturing company for a yearly period:

	₹ lakhs
Fixed expenses :	
Wages and salaries	9.5
Rent, rates and taxes	6.6
Depreciation	7.4
Sundry administration expenses	6.5
Semi-variable expenses (At 50% of capacity):	
Maintenance and repairs	3.5
Indirect labour	7.9
Sales department salaries, etc.	3.8
Sundry administration salaries	2.8
Variable expenses (At 50% of capacity):	
Materials	21.7
Labour	20.4
Other expenses	7.9
Total cost	98.0

Assume that the fixed expenses remain constant for all levels of production; semi-variable expenses remain constant between 45 per cent and 65 per cent of capacity, increasing by 10 per cent between 65 per cent and 80 per cent capacity and by 20 per cent between 80 per cent and 100 per cent capacity.

Sales at various levels are :

50% capacity	₹ 100 Lakhs	75% capacity	₹ 150 Lakhs
60% capacity	₹ 120 Lakhs	90% capacity	₹ 180 Lakhs
		100% capacity	₹ 200 Lakhs

Prepare a flexible budget for the year and forecast the profit at 60 per cent, 75 per cent, 90 per cent and 100 per cent of capacity. *(B. Com. Hons. Delhi)*

Solution

Flexible Budget for the period ...

(Figures in ₹ Lakhs)

Capacity Levels	*50%*	*60%*	*75%*	*90%*	*100%*
(A) Sales	100	120	150	180	200
Fixed expenses:					
Wages and salaries	9.5	9.5	9.5	9.5	9.5
Rent, rates and taxes	6.6	6.6	6.6	6.6	6.6
Depreciation	7.4	7.4	7.4	7.4	7.4
Sundry adm. expenses	6.5	6.5	6.5	6.5	6.5
(B) Total fixed cost	30.0	30.0	30.0	30.0	30.0
Semi-variable expenses:					
Maintenance and repairs	3.5	3.5	3.8	4.2	4.2
Indirect labour	7.9	7.9	8.7	9.5	9.5
Sales dept. salaries	3.8	3.8	4.2	4.6	4.6
Sundry adm. expenses	2.8	2.8	3.1	3.3	3.3
(C) Total semi-variable cost	18.0	18.0	19.8	21.6	21.6
Variable expanses:					
Material	21.7	26.0	32.5	39.0	43.4
Labour	20.4	24.5	30.6	36.7	40.8
Other expenses	7.9	9.5	11.9	14.3	15.8
(D) Total variable cost	50.0	60.0	75.0	90.0	100.0
(E) Total cost [(B) + (C) + (D)]	98.0	108.0	124.8	141.6	151.6
Profit (A – E)	2.0	12.0	25.2	38.4	48.4

Problem 2.3

The expenses budgeted for production of 10,000 units in a factory are furnished below :

	₹ per unit
Materials	70
Labour	25
Variable overheads	20
Fixed overheads (₹ 1,00,000)	10
Variable expenses (direct)	5
Selling expenses (10% fixed)	13
Distribution expenses (20% fixed)	7
Administration expenses (₹ 50,000)	5
Total	155

UniBuddies

Prepare a budget for the production of (*a*) 8,000 units, and (*b*) 6,000 units.
Assume that administration expenses are rigid for all levels of production.
(BBM Bangalore; C.A. Inter)

Solution

Flexible Budget *for the period.....*

	6,000 units		8,000 units		10,000 units	
	Per unit ₹	*Total* ₹	*Per unit* ₹	*Total* ₹	*Per unit* ₹	*Total* ₹
Materials	70	4,20,000	70	5,60,000	70	7,00,000
Labour	25	1,50,000	25	2,00,000	25	2,50,000
Direct exp. (variable)	5	30,000	5	40,000	5	50,000
Variable overhead	20	1,20,000	20	1,60,000	20	2,00,000
Fixed overhead	16.67	1,00,000	12.50	1,00,000	10	1,00,000
Selling exp : Fixed	2.17	13,000	1.63	13,000	1.30	13,000
Variable	11.70	70,200	11.70	93,600	11.70	1,17,000
Distribution expenses:						
Fixed	2.33	14,000	1.75	14,000	1.40	14,000
Variable	5.60	33,600	5.60	44,800	5.60	56,000
Adm. exp. : Fixed	8.33	50,000	6.25	50,000	5.00	50,000
Total Cost	166.80	10,00,800	159.42	12,75,400	155.00	15,50,000

Working Notes :

1. Material, labour, direct expenses and variable overhead are variable costs and do not change per unit. Total amount changes in proportion to number of units produced.
2. Fixed overhead total amount remains at ₹ 1,00,000 at all levels of output. Per unit fixed overhead is ₹ 1,00,000 divided by the number of units produced.
3. Adm. expenses are also fixed. It is calculated in the same manner as fixed overhead.
4. Selling expenses are 10% fixed when output is 10,000 units, *i.e.*, ₹ 13,000 (₹ 1.30 × 10,000 units). Variable selling expenses per unit are 90% of ₹ 13, *i.e.*, ₹ 11.70. Total fixed cost of ₹ 13,000 remains the same at each level and per unit is calculated by dividing ₹ 13,000 by the number of units at each level. Variable selling expense per unit is ₹ 11.70 which remains the same at each level. Total variable selling expenses are calculated by multiplying ₹ 11.70 by the number of units at each activity level.
5. Distribution expenses are calculated in the same way as selling expenses.

In the above flexible budgets, the following important points should be noted :

1. Total fixed costs for each level remains unchanged.
2. Per unit fixed cost decreases when level of output increases.
3. Total variable cost increases in proportion to increase in the level of output.
4. Per unit variable cost remains unchanged at each level.

Problem 2.4

A department of Alstom India Company attains sales of ₹ 6,00,000 at 80% of its normal capacity. Its expenses are given below :

	₹
Office salaries	90,000
General expenses	2% of sales
Depreciation	7,500
Rent and rates	8,750
Selling Cost:	
Salaries	8% of sales
Travelling expenses	2% of sales
Sales office	1% of sales
General expenses	1% of sales
Distribution Cost:	
Wages	15,000
Rent	1% of sales
Other expenses	4% of sales

Draw up Flexible Administration, Selling and Distribution Costs Budget, operating at 90 per cent, 100 per cent and 110 per cent of normal capacity. *(B.Com. Hons., Delhi; C.A. Inter)*

Solution

Flexible Budget
for the period ....

	80% ₹	*90%* ₹	*100%* ₹	*110%* ₹
Sales	6,00,000	6,75,000	7,50,000	8,25,000
Administration Costs:				
Office salaries (fixed)	90,000	90,000	90,000	90,000
General expenses (2% of sales)	12,000	13,500	15,000	16,500
Depreciation (fixed)	7,500	7,500	7,500	7,500
Rent and rates (fixed)	8,750	8,750	8,750	8,750
(A) Total Adm. Costs	1,18,250	1,19,750	1,21,250	1,22,750
Selling Costs:				
Salaries (8% of sales)	48,000	54,000	60,000	66,000
Travelling expenses (2% of sales)	12,000	13,500	15,000	16,500
Sales office (1% of sales)	6,000	6,750	7,500	8,250
General expenses (1% of sales)	6,000	6,750	7,500	8,250
(B) *Total Selling Costs*	72,000	81,000	90,000	99,000
Distribution Costs:				
Wages (fixed)	15,000	15,000	15,000	15,000
Rent (1% of sales)	6,000	6,750	7,500	8,250
Other expenses (4% of sales)	24,000	27,000	30,000	33,000
(C) Total Dist. Costs	45,000	48,750	52,500	56,250
Total Cost (A + B + C)	2,35,250	2,49,500	2,63,750	2,78,000

UniBuddies

Note: All fixed costs have been assumed to remain unchanged even at 110% capacity. However, in practice, fixed costs may change when capacity utilisation exceeds 100%.

Problem 2.5

The budget manager of Jupiter Electricals Limited is preparing flexible budget for the accounting year starting from 1 July, 2011.

The company produces one product—DETX II. Direct material costs ₹ 7 per unit. Direct labour averages ₹ 2.50 per hour and requires 1.6 hours to produce one unit of DETX II. Salesmen are paid a commission of Re 1 per unit sold. Fixed selling and administrative expenses amount to ₹ 85,000 per year.

Manufacturing overhead is estimated in the following amounts under specified volumes:

Volume of production (in units)	1,20,000	1,50,000
	₹	₹
Expenses :		
Indirect material	2,64,000	3,30,000
Indirect labour	1,50,000	1,87,500
Inspection	90,000	1,12,500
Maintenance	84,000	1,02,000
Supervision	1,98,000	2,34,000
Depreciation of plant and equipment	90,000	90,000
Engineering services	94,000	94,000
Total manufacturing overhead	9,70,000	11,50,000

Prepare a Total Cost Budget for 1,40,000 units of production. [*B.Com. Hons., Delhi*]

Solution

Budget for the year ending 30th June, 2012

		Output 1,40,000 units
		₹
Variable costs :		
1. Direct material @ ₹ 7 per unit		9,80,000
2. Direct labour @ ₹ 4 per unit		5,60,000
3. Salesmen's commission @ Re 1 per unit		1,40,000
4. Indirect materials @ ₹ 2.20 per unit		3,08,000
5. Indirect labour @ 1.25 per unit		1,75,000
6. Inspection @ ₹ 0.75 per unit		1,05,000
Semi-variable costs :		
1. Supervision	— Fixed	54,000
	— Variable @ ₹ 1.20 per unit	1,68,000
2. Maintenance	— Fixed	12,000
	— Variable @ ₹ 0.60 per unit	84,000
Fixed Costs :		
1. Depreciation		90,000
2. Engineering services		94,000
3. Selling and distribution expenses		85,000
	Total	28,55,000

Working Notes:

Fixed and variable components of each item of cost are determined as follows :

1. Indirect material

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in output}} = \frac{₹\ 3,30,000-2,64,000}{1,50,000-1,20,000 \text{ units}}$$

$$= \frac{66,000}{30,000} = ₹\ 2.20$$

$$\frac{₹\ 3,30,000 - 3,50,000}{10,000 \text{ units}}$$

Variable indirect material = 1,20,000 × ₹ 2.20 = ₹ 2,64,000 for 1,20,000 units.

Hence there is no fixed cost element and this item is purely variable. Similar calculation for indirect labour and inspection.

2. Supervision

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in output}} = \frac{₹\ 2,34,000-1,98,000}{1,50,000-1,20,000 \text{ units}}$$

$$= \frac{36,000}{30,000} = ₹\ 1.20 \text{ per unit}$$

Fixed supervision cost = 1,98,000 – (1,20,000 × 1.20) = ₹ 54,000

Similar calculation for maintenance cost.

3. Depreciation and engineering services costs are the same at two levels of production. Thus these are fixed costs.

Problem 2.6

The manager of Repairs and Maintenance Department in response to a request, submitted the following budget estimates for his department that are to be used to construct a flexible budget to be used during the coming budget year :

Details of cost	*Planned at 6,000 direct repair hours*	*Planned at 9,000 direct repair hours*
Employee salaries	30,000	30,000
Indirect repair materials	40,200	60,300
Miscellaneous cost, etc.	13,200	16,800

(*a*) Prepare a flexible budget for the department up to activity level of 10,000 repair hours (use increments of 1,000 hours).

(*b*) What would be the budget allowance at 8,500 direct repair hours?

(*C.S. Inter*)

Solution

Flexible Budget

for the period. ....

Direct repair hours	*6,000* ₹	*7,000* ₹	*8,000* ₹	*9,000* ₹	*10,000* ₹
Employee salaries	30,000	30,000	30,000	30,000	30,000
Indirect materials	40,200	46,900	53,600	60,300	67,000
Misc. costs : Fixed	6,000	6,000	6,000	6,000	6,000
Variable	7,200	8,400	9,600	10,800	12,000
Total	83,400	91,300	99,200	1,07,100	1,15,000

(*b*) **Budget allowance for 8,500 repair hours**

= Fixed cost + Variable cost for 8,500 repair hours.

= 36,000 + (8,500 hrs. × ₹ 7.90)*

= **₹ 1,03,150.**

***Working Notes :**

1. Employee salaries is a fixed cost and thus is the same at all levels.
2. Indirect repair material is a variable cost @ ₹ 6.70 (*i.e.*, 40,200 ÷ 6,000) per repair hour.
3. Misc. cost is a semi-variable item. It is separated into fixed and variable components as follows :

$$\textit{Variable} = \frac{\text{Difference in cost}}{\text{Difference in hours}} = \frac{16,800-13,200}{9,000-6,000} = \frac{3,600}{3,000}$$

= ₹ 1.20 per repair hour.

Fixed = [₹ 13,200 – (6,000 × ₹ 1.20)] = ₹ 6,000.

Total fixed cost = Employee salary + Misc. cost (fixed)

= 30,000 + 6,000 = ₹ 36,000.

Total variable cost per hour = Indirect material + Misc. cost

= ₹ 6.70 + 1.20 = **₹ 7.90 per hour.**

Problem 2.7

Excellent Manufacturers can produce 4,000 units of a certain product at 100% capacity. The following information is obtained from the books of account :

	Aug. 2017	Sept. 2017
Units produced	2,800	3,600
	₹	₹
Repairs and maintenance	500	560
Power	1,800	2,000
Shop labour	700	900
Consumable stores	1,400	1,800
Salaries	1,000	1,000
Inspection	200	240
Depreciation	1,400	1,400

Rate of production per hour is 10 units. Direct material cost per unit is ₹ 1 and direct wages per hour is ₹ 4.

You are required to :

(*i*) Compute the cost of production at 100%, 80% and 60% capacity showing the variable, fixed and semi-variable items under the flexible budget.

(*ii*) Find out the overhead absorption rate per unit at 80% capacity.

(C.S. Inter)

Solution

Flexible Budget

	100% *4,000 units* ₹	*80%* *3,200 units* ₹	*60%* *2,400 units* ₹
Variable costs :			
Direct materials [@ Re 1 per unit.]	4,000	3,200	2,400
Direct wages [@ ₹ 4 per hour for 10 units]	1,600	1,280	960
Shop labour	1,000	800	600
Consumable stores	2,000	1,600	1,200
Total '*A*'	8,600	6,880	5,160
Semi-variable costs :			
Power	2,100	1,900	1,700
Inspection	260	220	180
Repairs and maintenance	590	530	470
Total '*B*'	2,950	2,650	2,350
Fixed costs :			
Salaries	1,000	1,000	1,000
Depreciation	1,400	1,400	1,400
Total '*C*'	2,400	2,400	2,400
Total Cost (*A* + *B* + *C*)	13,950	11,930	9,910
Cost per unit (Total cost ÷ Units)	3.49	3.73	4.13

(*ii*) **Calculation of overhead absorption rate per unit at 80% capacity**

Total cost at 80%	₹ 11,930
Less : Direct material and direct wages (*i.e.*, ₹ 3,200 + 1,280)	4,480
Overhead cost	7,450

Overhead rate per unit = ₹ 7,450 ÷ 3,200 units = **₹ 2.33**

Working Notes:

Calculation of semi-variable costs.

$$\text{Variable cost per unit} = \frac{\text{Difference in cost}}{\text{Difference in units}}$$

$$\text{Power} = \frac{₹\ 2,000 - 1,800}{3,600 - 2,800 \text{ units}} = \frac{₹\ 200}{800 \text{ units}} = ₹\ 0.25$$

At 70%, fixed element in power cost = 1,800 – 700 (*i.e.*, 2,800 units @ 0.25 per unit)
= ₹ 1,100

UniBuddies'

Semi-variable power cost at 100% = 1,100 + 1,000 (*i.e.*, 4,000 units @ 0.25)
= ₹ 2,100

Semi-variable power cost at 80% = 1,100 + 800 (*i.e.*, 3,200 units @ 0.25)
= ₹ 1,900

Semi-variable power cost at 60% = 1,100 + 600 (*i.e.*, 2,400 units @ 0.25)
= ₹ 1,700

Similar calculations for inspection and repairs and maintenance.

Problem 2.8

For the production department of *HYL* Ltd you are required to :

(*a*) Prepare a fixed budget of overheads;

(*b*) Prepare a flexible budget of overheads at 70% and 110% of budgeted volume;

(*c*) Calculate a departmental hourly rates of overhead absorption as per (*a*) and (*b*) above. The budgeted level of activity of the department is 5,000 hours per period and a study of the various items of expenditure reveals the following :

		₹	₹ *per hr.*
Indirect wages		—	0.40
Repairs	Upto 2,000 hours	100	
	For each additional 500 hours up to a total of 4,000 hrs.	35	
	Additional from 4,001 to 5,000 hrs.	60	
	Additional above 5,000 hrs.	70	
Rent and rates		350	
Power	Up to 3,600 hours		0.25
	For hours above 3,600		0.20
Consumable supplies			0.24
Supervision	Up to 2,500 hours	400	
	Additional for each extra 600 hours above 2,500 and up to 4,900 hours	100	
	Additional above 4,900 hours	150	
Depreciation	Up to 5,000 hours	650	
	Above 5,000 hours and up to 6,500 hours	820	
Cleaning	Up to 4,000 hours	60	
	Above 4,000 hours	80	
Heat and lighting	From 2,100 hrs. to 3,500 hrs.	120	
	From above 3,500 hrs. to 5,000 hrs.	150	
	Above 5,000 hours	175	

UniBuddies'

Solution

Fixed and Flexible Budget *for the Period ....*

Items of Overhead	*Nature of Overhead*	*Fixed Budget*	*Flexible Budget*	
		100% 5,000 hrs.	70% 3,500 hrs.	110% 5,500 hrs.
		₹	₹	₹
Indirect wages	Variable	2,000	1,400	2,200
Repairs	Semi-variable	300	205	370
Rent and taxes	Fixed	350	350	350
Power	Semi-variable	1,180	875	1,280
Consumable supplies	Variable	1,200	840	1,320
Supervision	Semi-variable	950	600	950
Depreciation	—do—	650	650	820
Cleaning	—do—	80	60	80
Heat and lighting	—do—	150	120	175
Total overhead		6,860	5,100	7,545
Hourly rate of overhead (Total overhead ÷ Hours)		₹ 6,860 / 5,000 hrs = ₹ 1.37	₹ 5,100 / 3,500 hrs = ₹ 1.46	₹ 7,545 / 5,500 hrs = ₹ 1.37

Problem 2.9

Draw a material procurement budget (quantitative) from the following information:

Estimated sales of a product is 40,000 units. Each unit of the product requires 3 units of material A and 5 units of material B.

Estimated opening balances at the commencement of the next year:

Finished product	5,000 units
Material A	12,000 units
Material B	20,000 units
Materials on order:	
Material A	7,000 units
Material B	11,000 units
The desirable closing balances at the end of the next year:	
Finished product	7,000 units
Material A	15,000 units
Material B	25,000 units
Materials on order:	
Material A	8,000 units
Material B	10,000 units

(B.Com. Hons. Delhi Adapted)

UniBuddies'

Solution

Before preparing material procurement budget, it is necessary to estimate the production during the next year. This is done as given below :

	Units
Estimated sales	40,000
Add: Closing stock	7,000
	47,000
Less: Opening stock	5,000
Estimated Production during the year	42,000

Materials Procurement Budget (Quantitative)

	A Units		B Units	
Units of material required (@ 3 units of A and 5 units of B for 42,000 units of production)		1,26,000		2,10,000
Add: Closing stock required	15,000		25,000	
Material on order	8,000	23,000	10,000	35,000
		1,49,000		2,45,000
Less: Opening stock	12,000		20,000	
Material on order	7,000	19,000	11,000	31,000
Units to be procured		1,30,000		2,14,000

Problem 2.10

The following are the estimated sales of a company for eight months ending 30.11.2018:

Months	*Estimated sales (units)*
April 2018	12,000
May 2018	13,000
June 2018	9,000
July 2018	8,000
August 2018	10,000
September 2018	12,000
October 2018	14,000
November 2018	12,000

As a matter of policy, the company maintains the closing balance of finished goods and raw materials as follows :

Stock item	*Closing balance of a month*
Finished goods	50% of the estimated sales for the next month.
Raw materials	Estimated consumption for the next month.

Every unit of production requires 2 kg of raw material costing ₹ 5 per kg.

Prepare Production Budget (in units) and Raw Material Purchase Budget (in units and cost) of the company for the half year ending 30 September 2018.

(B Com Hons Delhi; I.C.W.A., Inter)

UniBuddies

Solution

Production Budget for the half year ending 30-9-2018

	April units	*May units*	*June units*	*July units*	*Aug. units*	*Sep. units*
Estimated Sales	12,000	13,000	9,000	8,000	10,000	12,000
Add: Closing stock	6,500	4,500	4,000	5,000	6,000	7,000
	18,500	17,500	13,000	13,000	16,000	19,000
Less: Opening stock	6,000	6,500	4,500	4,000	5,000	6,000
Estimated Production	12,500	11,000	8,500	9,000	11,000	13,000

Raw Material Purchase Budget for the year ending 30-9-2018

	April kg	*May kg*	*June kg*	*July kg*	*Aug. kg*	*Sep. kg*
Material @ 2 kg p.u. of production	25,000	22,000	17,000	18,000	22,000	26,000
Add: Closing stock	22,000	17,000	18,000	22,000	26,000	26,000
	47,000	39,000	35,000	40,000	48,000	52,000
Less: Opening stock	25,000	22,000	17,000	18,000	22,000	26,000
Purchases	22,000	17,000	18,000	22,000	26,000	26,000
Cost of purchases @ ₹ 5 per kg ₹	1,10,000	85,000	90,000	1,10,000	1,30,000	1,30,000

Problem 2.11

Flex Food Products Limited has prepared the following Sales Budget for the first five months of 2018 :

	Sales Budget (in units)
January	10,800
February	15,600
March	12,200
April	10,400
May	9,800

The inventory of finished products at the end of every month is to be equal to 25 percent of the sales estimate for the next month. On 1 January 2018, there were 2,700 units of product on hand. There is no work-in-process at the end of any month.

Every unit of product requires two types of materials in the following quantities:

Material *A*	4 kg.
Material *B*	5 kg.

Materials equal to one-half of the next month's production are to be in hand at the end of every month. This requirement was met on 1 January, 2018.

Budgeted prices for the purchase of materials are :

Material *A* — ₹ 3 per kg, Material *B* — ₹ 2 per kg.

Prepare a Materials Budget for the first quarter of 2011 in a logical form showing the quantities of each type of material to be purchased every month. Also prepare a Purchase Budget.

(B.Com. Hons. Delhi, Adapted,)

Solution

Before preparing material budget, production has to be estimated by preparing a production budget.

Production Budget

For the Quarter Ist Jan. to 31st March, 2018

Particulars	*Budget Period*			
	Jan units	*Feb. units*	*March units*	*April*
Estimated sales	10,800	15,600	12,200	10,400
Add : Closing stock	3,900	3,050	2,600	2,450
	14,700	18,650	14,800	12,850
Less : Opening stock	2,700	3,900	3,050	2,600
Production	12,000	14,750	11,750	10,250

Working Note:

Calculation of closing stock and opening stock

Closing Stock	**Opening stock**
Jan. 25% of 15,600 units = 3,900	25% of 10,800 units for Jan. = 2,700
Feb. 25% of 12,200 units = 3,050	Closing stock of Jan. is opening stock of Feb and closing stock of Feb. is opening stock of March.
March 25% of 10,400 units = 2,600	

Material Budget

For the Quarter Jan. 1 to March 31, 2018

Particulars	*Jan.*		*Feb.*		*March*	
	A kg.	*B kg.*	*A kg.*	*B kg.*	*A kg.*	*B kg.*
Material for production						
@ 4 kg. per unit for *A*	48,000	60,000	59,000	73,750	47,000	58,750
@ 5 Kg per unit for *B*						
Add : Closing stock	29,500	36,875	23,500	29,375	20,500	25,625
	77,500	96,875	82,500	1,03,125	67,500	84,375
Less : Opening stock	24,000	30,000	29,500	36,875	23,500	29,375
Quantity to be purchased	53,500	66,875	53,000	66,250	44,000	55,000

UniBuddies

Working Notes:

Closing stock for each month is calculated as under :

For *A*

Jan. — 50% of 59,000 kg. = 29,500 kg.
Feb. — 50% of 47,000 kg. = 23,500 kg.
Mar. — 50% of (10,250 × 4 kg.) = 20,500 kg.

For *B*

Jan. — 50% of 73,750 kg. = 36,875 kg.
Feb. — 50% of 58,750 kg. = 29,375 kg.
Mar. — 50% of (10,250 × 5 kg.) = 25,625 kg.

Purchases Budget

For the Quarter Jan 1 of March 31, 2018

Material	Jan.			Feb.			Mar.			Total
	Qty. kg.	Price ₹	Amt. ₹	Qty. kg.	Price ₹	Amt. ₹	Qty. kg.	Price ₹	Amt. ₹	Amt. ₹
A	53,500	3	1,60,500	53,000	3	1,59,000	44,000	3	1,32,000	4,51,500
B	66,875	2	1,33,750	66,250	2	1,32,500	55,000	2	1,10,000	3,76,250
Total			2,94,250			2,91,500			2,42,000	8,27,750

Problem 2.12

Asahee Glass Company requires you to present the budget for the next year from the following information :

Sales :
- Toughened Glass — ₹ 6,00,000
- Bent Glass — ₹ 2,00,000

Direct material cost — 60% of sales
Direct wages — 20 workers @ ₹ 150 per month
Factory overheads :
- Indirect labour —
  - Works manager — ₹ 500 per month
  - Foreman — ₹ 400 per month
- Stores and spares — 2.5% on sales
- Depreciation on machinery — ₹ 12,600
- Light and power — ₹ 3,000
- Repairs and maintenance — ₹ 8,000
- Other sundries — 10% on direct wages
- Administration, selling and distribution expenses — ₹ 30,000 per year

(B.Com. Bharathidasan)

UniBuddies'

Solution

Master Budget *for the year ending....*

				₹
Sales:				
Toughened Glass				6,00,000
Bent Glass				2,00,000
	Total Sales			8,00,000
Less: Direct materials (60% of ₹ 8,00,000)			4,80,000	
Direct wages (20 workers × ₹ 150 × 12 months)			36,000	
	Prime Cost		5,16,000	
Fixed Factory Overhead :				
Works manager's salary (₹ 500 × 12 months)		6,000		
Foreman's salary (₹ 400 × 12 months)		4,800		
Depreciation		12,600		
Light and power		3,000	26,400	
Variable Factory Overhead :				
Stores and spares		20,000		
Repairs and maintenance		8,000		
Sundry expenses		3,600	31,600	
	Works Cost			5,74,000
	Gross Profit			2,26,000
Less: Adm., selling and dist. expenses				30,000
	Net Profit			1,96,000

Problem 2.13

The following data relate to Bookhive Ltd:

The financial manager has made the following sales forecasts for the first five months of the coming year, commencing from 1st April, 2011:

Month	*Sales (₹)*
April	40,000
May	45,000
June	55,000
July	60,000
August	50,000

Other data:

(*i*) Debtors' and creditors' balance at the beginning of the year are ₹ 30,000 and ₹ 14,000 respectively. The balance of other relevant assets and liabilities are:

Cash Balance	₹ 7,500
Stock	₹ 51,000
Accrued Sales Commission	₹ 3,500

(*ii*) 40% sales are on cash basis. Credit sales are collected in the month following the sale.

(*iii*) Cost of sales in 60 per cent on sales.

(*iv*) The only other variable cost is a 5% commission to sales agents. The Sales Commission is paid in a month after it is earned.

(*v*) Inventory (stock) is kept equal to sales requirements for the next two month budgeted sales.

(vi) Trade creditors are paid in the following month after purchases.
(vii) Fixed costs are ₹ 5,000 per month including ₹ 2,000 depreciation.
You are required to prepare a cash Budget for the month of April, May and June, 2011 respectively.

(*B.Com. Hons., Delhi*)

Solution

Cash Budget
For the month of April, May and June, 2011

	April ₹	*May* ₹	*June* ₹
Opening Balance	7,500	33,000	37,000
Receipts :			
Cash Sales (40% of sales)	16,000	18,000	22,000
Receipt for debtors	30,000	24,000*	27,000*
Total cash available (*A*)	53,500	75,000	86,000
Payments :			
Creditors	14,000	33,000*	36,000*
Fixed cost (5000 – 2000)	3,000	3,000	3,000
Commission to sales agents	3,500	2,000	2,250
Total Payment (*B*)	20,500	38,000	41,250
Closing balance (*A* – *B*)	33,000	37,000	44,750

***Working Notes :**

1. Calculation of rieceipts from debtors, purchases and payment to creditors (assuming that all purchases are ar on credit basis)

	April ₹	*May* ₹	*June* ₹	*July* ₹	*August* ₹
Credit sales 60% of total sales	24,000	27,000	33,000	36,000	30,000
Cost of sales 60% of total sales	24,000	27,000	33,000	36,000	30,000
Desired closing inventory at cost	60,000	69,000	66,000		
	84,000	96,000	99,000		
Less: Opening Inventory	51,000	60,000	69,000		
Purchases	33,000	36,000	30,000		
Payment to creditors	14,000	33,000	36,000		

Problem 2.14

Prepare a Cash Budget for the three months ending 30th June, 2018 from the information given below :

(*a*)

Month	*Sales* ₹	*Materials* ₹	*Wages* ₹	*Overheads* ₹
February	14,000	9,600	3,000	1,700
March	15,000	9,000	3,000	1,900
April	16,000	9,200	3,200	2,000
May	17,000	10,000	3,600	2,200
June	18,000	10,400	4,000	2,300

(*b*) Credit terms are :

Sales and debtors — 10% of sales are on cash, 50% of the credit sales are collected next month and the balance in the following month :

Creditors —	Materials	2 months
	Wages	1/4 month
	Overheads	1/2 month

(*c*) Cash and bank balance on Ist April, 2018 is expected to be ₹ 6,000.

(*d*) Other relevant informations are :

(*i*) Plant and machinery will be installed in February 2018 at a cost of ₹ 96,000. The monthly instalment of ₹ 2,000 is payable from April onwards.

(*ii*) Dividend @ 5% on Preference Share Capital of ₹ 2,00,000 will be paid on 1st June.

(*iii*) Advance to be received for sale of vehicles ₹ 9,000 in June.

(*iv*) Dividends from investments amounting to ₹ 1,000 are expected to be received in June.

(*v*) Income tax (advance) to be paid in June is ₹ 2,000. *(I.C.W.A., Inter)*

Solution

Cash Budget

For three months ending 30th June, 2018

	April ₹	*May* ₹	*June* ₹	*Total* ₹
Balance b/f	6,000	3,950	3,000	6,000
Receipts :				
Sales*	14,650	15,650	16,650	46,950
Dividend	—	—	1,000	1,000
Advance against vehicle	—	—	9,000	9,000
Total	20,650	19,600	29,650	62,950
Payments :				
Creditors (materials)	9,600	9,000	9,200	27,800
Wages	3,150	3,500	3,900	10,550
Overheads	1,950	2,100	2,250	6,300
Instalment for plant	2,000	2,000	2,000	6,000
Pref. dividend	—	—	10,000	10,000
Income-tax advance	—	—	2,000	2,000
Total	16,700	16,600	29,350	62,650
Closing balance	3,950	3,000	300	300

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Working Notes :

1. Calculation of collection from debtors

	Feb. ₹	March ₹	April ₹	May ₹	June ₹
Sales	14,000	15,000	16,000	17,000	18,000
Cash sales (10%)	1,400	1,500	1,600	1,700	1,800
Credit sales	12,600	13,500	14,400	15,300	16,200
50% collection in next month			6,750	7,200	7,650
50% collection in the following month			6,300	6,750	7,200
Total collection			13,050	13,950	14,850
Cash sales			1,600	1,700	1,800
Cash receipts from sales			14,650	15,650	16,650

2. Payment to creditors for materials, wages and overhead have been computed on a similar pattern.
   (*i*) For example, payment for creditors for materials will be : February purchases will be paid in April, March purchases will be paid in May, and April purchases will be paid in June.
   (*ii*) Payment for wages in April = $(3{,}000 \times 1/4) + (3{,}200 \times 3/4)$ = ₹ 3,150
   May = $(3{,}000 \times 1/4) + (3{,}600 \times 3/4)$ = ₹ 3,500
   June = $(3{,}000 \times 1/4) + (4{,}000 \times 3/4)$ = ₹ 3,900
   (*iii*) Payment for overhead in April = $(1{,}900 \times 1/2) + (2{,}000 \times 1/2)$ = ₹ 1,950.
   Similar calculations are made for May and June.

Problem 2.15

From the following information prepare Cash budget of a company :

	Ist Qtr.	*2nd Qtr.*	*3rd Qtr.*	*4th Qtr.*
	₹	₹	₹	₹
Opening cash balance	10,000	—	—	—
Collection from customers	1,25,000	1,50,000	1,60,000	2,21,000
Payments :				
Purchase of materials	20,000	35,000	35,000	54,200
Other expenses	25,000	20,000	20,000	17,000
Salary and wages	90,000	95,000	95,000	1,09,200
Income tax	5,000	—	—	—
Purchase of machinery	—	—	—	20,000

The company desired to maintain a cash balance of ₹ 15,000 at the end of each quarter. Cash can be borrowed or repaid in multiples of ₹ 500 at an interest of 10% per annum. Management does not want to borrow cash more than what is necessary and wants to repay as early as possible. In any event, loans cannot be extended beyond four quarters. Interest is computed and paid when the principal is repaid. Assume that borrowings take place at the beginning and repayments are made at the end of the quarters.

(I.C.W.A., Inter)

UniBuddies

Solution

Cash Budget for the period .....

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
	₹	₹	₹	₹
Opening Cash Balance	10,000	15,000	15,000	15,325
Add: Collections from customers	1,25,000	1,50,000	1,60,000	2,21,000
Total Cash Available (*A*)	1,35,000	1,65,000	1,75,000	2,36,325
Payments :				
Purchase of materials	20,000	35,000	35,000	54,200
Other expenses	25,000	20,000	20,000	17,000
Salary and wages	90,000	95,000	95,000	1,09,200
Income tax	5,000	—	—	—
Purchase of machinery	—	—	—	20,000
Total Cash Payments (*B*)	1,40,000	1,50,000	1,50,000	2,00,400
Minimum cash balance required	15,000	15,000	15,000	15,000
Total cash required (*C*)	1,55,000	1,65,000	1,65,000	2,15,400
Excess (Deficit) (*A*) – (*C*)	(20,000)	—	10,000	20,925
Financing :				
Borrowing	20,000	—	—	—
(Repayment)	—	—	(9,000)	(11,000)
Interest payment	—	—	(675)	(1,100)
Total effect of financing (*D*)	20,000	—	(9,675)	(12,100)
Closing Cash Balance (*A* + *D* – *B*)	15,000	15,000	15,325	23,825

Problem 2.16

The cost accountant of a manufacturing company provides you the following details for the year 2017:

	₹		₹
Direct materials	1,75,000	Other variable costs	80,000
Direct wages	1,00,000	Profit	1,15,000
Fixed factory overheads	1,00,000	Other fixed costs	80,000
Variable factory overheads	1,00,000	Sales	7,50,000

During the year, the company manufactured two products A and B and the output and costs were:

	A	*B*
Output (units)	2,00,000	1,00,000
Selling price per unit	₹ 2.00	₹ 3.50
Direct materials per unit	₹ 0.50	₹ 0.75
Direct wages per unit	₹ 0.25	₹ 0.50

Variable factory overhead are absorbed as a percentage of direct wages and other variable costs have been computed as :

Product A ₹ 0.25 per unit, and B ₹ 0.30 per unit.

During 2018, it is expected that the demand for product A will fall by 25% and for B by 50%. It is decided to manufacture a additional product C, the costs etc. for which are estimated as follows :

	Product C
Output (units)	2,00,000
Selling price per unit	₹ 1.75
Direct materials per unit	₹ 0.40
Direct wages per unit	₹ 0.25

It is anticipated that the other variable costs per unit will be the same as for Product A.

Prepare a budget to present to the management, showing the current position and for 2018. Comment on the comparative results. *(B.Com. Hons., Delhi;)*

Solution

Budget Showing Current Position and Position for 2018

(Particulars)	*Current Position*			*Position for 2018*			
	A	*B*	*Total (A + B)*	*A*	*B*	*C*	*Total (A+B+C)*
Sales (units)	2,00,000	1,00,000	—	1,50,000	50,000	2,00,000	—
	₹	₹	₹	₹	₹	₹	₹
(A) Sales (₹)	4,00,000	3,50,000	7,50,000	3,00,000	1,75,000	3,50,000	8,25,000
Direct materials	1,00,000	75,000	1,75,000	75,000	37,500	80,000	1,92,500
Direct wages	50,000	50,000	1,00,000	37,500	25,000	50,000	1,12,500
Factory overhead (variable)	50,000	50,000	1,00,000	37,500	25,000	50,000	1,12,500
Other variable costs	50,000	30,000	80,000	37,500	15,000	50,000	1,02,500
(B) Marginal cost	2,50,000	2,05,000	4,55,000	1,87,500	1,02,500	2,30,000	5,20,000
(C) Contribution (A – B)	1,50,000	1,45,000	2,95,000	1,12,500	72,500	1,20,000	3,05,000
Fixed cost:Factory			1,00,000				1,00,000
Others			80,000				80,000
(D) Total fixed cost			1,80,000				1,80,000
Profit (C – D)			1,15,000				1,25,000

Comments. Introduction of product C is likely to increase profit by ₹ 10,000 (*i.e.*, from ₹ 1,15,000 to ₹ 1,25,000) in 2018 as compared to 2017. Therefore, introduction of product C is recommended.

Problem 2.17

The profitability statement of Gourmet Co. Ltd. has been summarised as follows :

	₹	₹
Sales		15,00,000
Direct materials	4,50,000	
Direct Wages	3,00,000	
Variable overheads	1,20,000	
Fixed overheads	4,40,000	13,10,000
Profit		1,90,000

The budgeted capacity of the company is ₹ 20,00,000 but the key factor is sales demand. It is proposed that in order to utilise the existing capacity, the selling price of this only product manufactured by the company should be reduced by 5%.

You are required to prepare a budget which should show the effect of the proposed reduction in selling price and include any changes in costs expected during the coming year. The following additional information is given:

1. Sales forecast ₹ 19,00,000 (after reduction).
2. Direct material prices are expected to increase by 2%.
3. Direct wage rates are expected to increase by 5% per unit.
4. Variable overheads are expected to increase by 5% per unit.
5. Fixed overhead will increase by ₹ 20,000. *(B.Com. Hons., Delhi)*

Solution

Budget for the period.....

			₹
	Sales		19,00,000
Less :	Variable costs :		
	Direct materials (4,50,000 × 4/3)* + 2%	6,12,000	
	Direct wages (3,00,000 × 4/3)* + 5%	4,20,000	
	Variable overhead (1,20,000 × 4/3)* + 5%	1,68,000	12,00,000
	Contribution		7,00,000
Less :	Fixed cost (4,40,000 + 20,000)		4,60,000
	Profit		2,40,000

***Working Note :**

Budgeted sales in relation to present sales $= \frac{20,00,000}{15,00,000} = \frac{4}{3}$.

Problem 2.18

A single product company estimated its sales for the next year, quarter-wise as under :

Quarter	*Sales units*
I	30,000
II	37,500
III	41,250
IV	45,000

The opening stock of finished goods is 10,000 units and the company expects to maintain the closing stock of finished goods at 16,250 units at the end of the year. The production pattern in each quarter is based on 80% of the sales of the current quarter and 20% of the next quarter.

The opening stock of raw materials in the beginning of the year is 10,000 kg. and the closing stock at the end of the year is required to be maintained at 5,000 kg. Each unit of finished output requires 2 kg. of raw materials.

The company proposes to purchase the entire annual requirement of raw materials in the first three quarters in the proportion and at the prices given below :

Quarter	*Purchase of raw materials % of total annual requirement in quantity*	*Price per kg.* ₹
I	30%	2
II	50%	3
III	20%	4

The value of the opening stock of raw materials in the beginning of the year is ₹ 20,000.

You are required to present the following for the next year, quarter-wise :

(*i*) Production budget in units.

(*ii*) Raw material consumption budget in quantity.

(*iii*) Raw material purchase budget in quantity and value.

(*iv*) Priced stores ledger card of the raw material using first-in-first-out method.

(*B.Com. Hons., Delhi; C.A. Inter*)

Solution

Calculation of Estimated Production

	Units
Estimated sales per year (30,000 + 37,500 + 41,250 + 45,000)	1,53,750
Add : Closing stock	16,250
	1,70,000
Less : Opening stock	10,000
Estimated production	1,60,000

(*i*) **Production Budget**

	Quarters				*Total*
	I	II	III	IV	V
Sales (units)	30,000	37,500	41,250	45,000	1,53,750
Production (80% of sales of current quarter)	24,000	30,000	33,000	36,000	
Production (20% of sales of next quarter)	7,500	8,250	9,000	12,250	
Production	31,500	38,250	42,000	48,250	1,60,000

(*ii*) **Raw Material Consumption Budget in Quantity**

Raw material consumption in kg. = Units of production × Consumption per unit

Quarter	I	31,500 × 2 kg.	=	63,000 kg.
	II	38,250 × 2 kg.	=	76,500 kg.
	III	42,000 × 2 kg.	=	84,000 kg.
	IV	48,250 × 2 kg.	=	96,500 kg.
	Total			3,20,000 kg.

(iii) Raw material Purchase Budget in Quantity

	kg.
Raw material required for production	3,20,000
Add : Closing stock	5,000
	3,25,000
Less : Opening stock	10,000
Materials to be purchased	3,15,000

Raw Material Purchase Budget (in ₹)

Quarter	*Qty. to be purchased*	*Rate per kg.* ₹	*Amount* ₹
I	3,15,000 × 30% = 94,500 kg.	2	1,89,000
II	3,15,000 × 50% = 1,57,500 kg.	3	4,72,500
III	3,15,000 × 20% = 63,000 kg.	4	2,52,000
	Total 3,15,000 kg.		9,13,500

(iv) Stores Ledger Card (FIFO Methed)

Quarter	*Receipts*			*Issues*			*Balance*		
Date	*Qty.* kg.	*Rate* ₹	*Amount* ₹	*Qty.* kg.	*Rate* ₹	*Amount* ₹	*Qty* kg.	*Rate* ₹	*Amount* ₹
I	—	—	—	—	—	—	10,000	2	20,000
	94,500	2	1,89,000	—	—	—	1,04,500	2	2,09,000
	—	—	—	63,000	2	1,26,000	41,500	2	83,000
II	1,57,500	3	4,72,500	—	—	—	41,500	2	83,000
							1,57,500	3	4,72,500
	—	—	—	41,500	2	83,000			
				35,000	3	1,05,000	1,22,500	3	3,67,500
III	63,000	4	2,52,000	—	—	—	1,22,500	3	3,67,500
							63,000	4	2,52,000
	—	—	—	8,4000	3	2,52,000	38,500	3	1,15,500
							63,000	4	2,52,000
IV	—	—	—	38,500	3	1,15,500			
				58,000	4	2,32,000	5,000	4	20,000

Problem 2.19

The operating results of *GOE*. Ltd. for the year ending 31st December, 2011 are summarised below:

	₹ *in lakhs*
Sales – 40,000 units	48.00
Less: Trade discount	2.40
Net sales	45.60
Cost of sales :	
Direct materials	14.40
Direct labour	12.60

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Factory overheads	6.30
Administration overheads	3.60
Selling and distribution overheads	4.50

The following changes are to be incorporated in the budget for the year 2012 :

(*a*) Sales (units) to be increased by 25%;

(*b*) Material price to increase by 15%;

(*c*) Direct wages to go up by 12%;

(*d*) Overheads-factory overheads will increase by 15%. In addition, a new facility will be added to the factory laboratory at a recurring cost of ₹ 12,500 per year. Administrative and selling and distribution overheads are estimated to increase by 10% and 14% respectively;

(*e*) Inventory—no change;

(*f*) Profit target for the year has been fixed at ₹ 6 lakhs; and

(*g*) No change in the rate of trade discount.

Calculate the unit selling price and present the budget for 2012 in a meaningful format.

(B.Com. Hons Delhi; I.C.W.A., Inter)

Solution

Budget for the year ending 31st Dec. 2012

	(*Fig in ₹ lakhs*)	
	Year 2012 (50,000 units)	*Year 2011 (40,000 units)*
Sales	64.00	48.00
Less: Trade discount	3.20	2.40
(A) Net Sales	60.80	45.60
Cost of sales:		
Direct materials	20.70	14.40
Direct labour	17.64	12.60
Factory overhead	7.37	6.30
Adm. overhead	3.96	3.60
Selling and dist. overhead	5.13	4.50
(B) Total Cost	54.80	41.40
Profit (A – B)	6.00	4.20

$$\text{Unit Selling Price} = \frac{₹\ 64,00,000}{50,000 \text{ units}} = ₹\ 128$$

Working Notes :

For the year 2012, figures are calculated as follows :

1. Sales units	= 40,000 × 125%	= 50,000 units
2. Material cost	= 14.40 × 1.15 × 125%	= ₹ 20.70
3. Labour cost	= 12.60 × 1.12 × 125%	= ₹ 17.64
4. Factory overhead	= (6.30 × 1.15) + 0.125	= ₹ 7.37
5. Adm. overhead	= 3.60 × 110%	= ₹ 3.96
7. Selling and dist overhead	= 4.50 × 114%	= ₹ 5.13

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Problem 2.20

GESCO Ltd. is currently operating at 75% of its capacity. In the past two years' the level of operations were 55% and 65% respectively. Presently, the production is 75,000 units. The company is planning for 85% capacity level during 2011-12. The cost details are as follow :

Particulars :	55%	65%	75%
	₹	₹	₹
Direct materials	11,00,000	13,00,000	15,00,000
Direct labour	5,50,000	6,50,000	7,50,000
Factory overheads	3,10,000	3,30,000	3,50,000
Selling overheads	3,20,000	3,60,000	4,00,000
Administrative overheads	1,60,000	1,60,000	1,60,000
	24,40,000	28,00,000	31,60,000

Profit is estimated @ 20% on sales. The following increases in costs are expected during the year:

	In percentage
Direct materials	8
Direct labour	5
Variable factory overheads	5
Variable selling overheads	8
Fixed factory overheads	10
Fixed selling overheads	15
Administrative overheads	10

Prepare a flexible budget for the period 2011-12 at 85% level of capacity and ascertain the profit on sales. (*B.Com. Hons; Delhi*)

Solution

Flexible Budget *for the period 2011-12*

	For 85,000 units
	₹
Direct materials (₹ 20 + 8%) × 85,000 units	18,36,000
Direct labour (₹ 10 + 5%) × 85,000 units	8,92,500
Factory overhead - Fixed (2,00,000 + 10%)	2,20,000
Variable (₹ 2 + 5%) × 85,000 units	1,78,500
Administration overhead (1,60,000 + 10%)	1,76,000
Selling overhead - Fixed (1,00,000 + 15%)	1,15,000
Variable (₹ 4 + 8%) × 85,000 units	3,67,200
Total cost	37,85,200
Profit (25% on cost or 20% on sales)	9,46,300
Sales	47,31,500

Note : Factory overhead and selling overhead are semi-variable items and are segregated by the following methods :

$$\text{Variable overhead} = \frac{\text{Difference in overhead at two levels}}{\text{Difference in output}}$$

Variable factory overhead $= \frac{₹\ 3,30,000 - 3,50,000}{10,000 \text{ units}} = ₹\ 2$ per unit

Fixed factory overhead = ₹ 3,30,000 – (65,000 units × ₹ 2) = ₹ 2,00,000

Similar calculation may be made for selling overhead.

Problem 2.22

From the following information relating to 2017 and conditions expected to prevail in 2018, prepare a budget for 2018.

2017 *Actuals :*

	₹
Sales	1,00,000 (40,000 units)
Raw materials	53,000
Wages	11,000
Variable overheads	16,000
Fixed overheads	10,000

2018 *Prospects :*

Sales	1,50,000 (60,000)
Raw material	5% price increase
Wages	10% increase in wage rate
	5% increase in productivity
Additional plant	One lathe ₹ 28,000
	One drill ₹ 9,000

Rate of depreciation is 10%.

(Adapted)

Solution

Budget for 2018

	Actuals for 2017	*Budget for 2018*
Output (units)	40,000	60,000
Sales	₹ 1,00,000	₹ 1,50,000
Variable costs :		
Raw materials	53,000	83,475
Wages	11,000	17,286
Variable overheads	16,000	24,000
	80,000	1,24,761
Fixed overheads:	10,000	13,700
Total cost	90,000	1,38,461
Profit (Sales – Total cost)	10,000	11,539

Working Notes :

(*a*) Material cost in 2018 = $53,000 \times \frac{60,000 \text{ units}}{40,000 \text{ units}} \times 105\% = ₹\ 83,475$

(*b*) Wages in 2018 = $11,000 \times \frac{60,000 \text{ units}}{40,000 \text{ units}}$ = ₹ 16,150

Add : 10% increase due to wage rate 1,615

Total 18,150

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Less : Saving due to increase in productivity

$\left(18{,}150 \times \frac{5}{105}\right)$ 864

17,286

(c) Fixed overhead in 2018 = ₹ 10,000 + 10% dep. (on 28,000 + 9,000) = ₹ 13,700

KEY TERMS

Budget is a plan relating to a definite future period of time, expressed either in monetary or quantitative terms or in both.

Budgeting The process of preparing the budgets is known as budgeting.

Budgetary control is a system of controlling through preparation of budgets.

Functional Budgets For each function of the business, a separate budgets is prepared, e.g., sales budget, production budget, purchase budget, labour cost budget, cash budget, etc.

Master Budget It is a summary of all the functional budgets.

Fixed Budget It is a budget which is prepared keeping in mind one level of output.

Flexible Budget It is a budget "which is designed to change in relation to the level of activity attained."

Zero base budgeting (ZBB) is a method of budgeting in which previous year's figures are not taken as the base for preparing next year's budget. Instead, the budget figures are developed with zero as the base, i.e. the budget is prepared as if it is being prepared for a new company for the first time.

Performance budgeting is a relatively new concept which focuses on functions, programmes and activities as it lays emphasis on achievement of physical targets.

EXAMINATION QUESTIONS

Objective Type Questions

True or False ?

1. A master budget is a summary of all functional budgets.
2. Fixed budgets are most suited for fixed expenses.
3. All functional budgets should be coordinated with the sales budget which is always prepared first.
4. The budget that is prepared first and all other budgets are subordinate to it is Cash Budget.
5. A system of budgetary control can be used even when standard costing is in use in a concern.
6. A budget is a forecast of future expenditure.
7. Principal budget factor is the same as key factor.
8. A budget coordinates the activities of various departments.
9. A budget centre is a part of the organisation for which a seperate budget is prepared.
10. In a fixed budget, figures are adjusted according to actual level of activity.

[**Ans.** 1. True; 2. True; 3. False; 4. False; 5. True; 6. False; 7. True; 8. True; 9. True; 10. False]

Essay Type Questions

1. Define budget and budgetary control. State the advantages of budgetary control in an organisation. (*B.Com., Hons. Delhi*)
2. Distinguish between budget and forecast. (*B.Com. Hons., Delhi*)

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3. Write explanatory note on functions of budgeting. *(B.Com. Hons., Delhi)*
4. List the important functional budgets prepared by a business. *(B.Com. Hons., Delhi; C.A. Inter)*
5. Discuss briefly the objectives and limitations of budgetary control. *(B.Com. Hons. Delhi. Andhra; Nagarjuna)*
6. What are the main objectives of a system of budgetory control. Do you think budgetary control is subject to certain limitations ? *(B.Com. Hons., Delhi)*
7. Discuss the necessary steps to the success of a budgetary control system in an organisation. *(B.Com. Hons., Delhi)*
8. What do you think are the essentials of an effective budgetary control system. *(B.Com. Hons., Delhi)*
9. What is sales budget? How is it prepared? *(B.Com. Hons., Delhi)*
10. What factors would you consider when preparing a purchase budget? *(I.C.W.A., Inter)*
11. Distinguish between fixed budget and flexible budget. Briefly state the circumstances in which flexible budgets are used. *(B.Com. Hons., Delhi;)*
12. What is a cash budget ? What are its uses? *(B.Com. Hons., Delhi)*
13. Explain (a) Zero base budgeting (b) Master budget. *(B.Com. Hons., Delhi)*
14. Distinguish between zero base budget and conventional budget. *(B.Com. Hons., Delhi)*
15. Write a short note on principal budget factor. *(I.C.W.A. Inter)*
16. What is zero base budgeting? What are the advantages of zero base approach over traditional approach? *(I.C.W.A. Inter)*
17. Write a note on performance budgeting. *(B.Com. Hons., Delhi)*

Practical Questions

1. *ABC* Ltd. has prepared the budget for the production of a lakh units of the only commodity manufactured by it for a costing period as under :

Raw material	₹ 2.52 per unit
Direct labour	0.75 per unit
Direct expenses	0.10 per unit
Work overheads (60% fixed)	2.50 per unit
Administration overheads (80% fixed)	0.40 per unit
Selling overheads (50% fixed) .	0.20 per unit

The actual production during the period was only 60,000 units.

Calculate the revised budgeted cost per unit. *(B.Com.)*

[Ans. Revised cost per unit ₹ 7.75]

2. The cost at a capacity level of 5,000 units is given below. For a variation of 20% in capacity above or below this level, the individual expenses vary as indicated.

	₹
Material cost	25,000 (100% varying)
Labour cost	15,000 (100% varying)
Power	1,250 (80% varying)
Repairs and maintenance	2,000 (75% varying)
Stores	1,000 (100% varying)
Inspection	500 (20% varying)
Depreciation	10,000 (100% fixed)
Adm. overheads	5,000 (25% varying)
Selling overheads	3,000 (50% varying)
Total	62,750
Cost per unit	12.55

Find the unit cost of the product at production levels of 4,000 units and 6,000 units. (*I.C.W.A. Inter*)

[**Ans.** Unit cost at 4,000 units ₹ 13.37; at 6,000 units ₹ 12.00]

3. Production costs of Oriental Enterprises Limited are as follows :

	Level of Activity		
	60%	*70%*	*80%*
Output (in units)	1,200	1,400	1,600
Costs (in ₹) :			
Direct materials	24,000	28,000	32,000
Direct labour	7,200	8,400	9,600
Factory overheads	12,800	13,600	14,400
Works cost	44,000	50,000	56,000

A proposal to increase production to 90% level of activity is under the consideration of management. The proposal is not expected to involve any increase in fixed factory overheads. Prepare a statement showing the prime cost, total marginal cost and total factory cost at 90% level of activity. (*B.Com. Hons., Delhi*)

[**Ans.** Factory cost at 90% ₹ 62,000]

4. For production of 10,000 Electrical Irons, the following are budgeted expenses:

	Per unit ₹
Direct materials	60
Direct labour	30
Variable overhead	25
Fixed overhead (₹ 1,50,000)	15
Variable expenses (direct)	5
Selling expenses (10% fixed)	15
Administration expenses (₹ 50,000 rigid of all levels of production)	5
Distribution expenses (20% fixed)	5
Total cost of sales per unit	160

Prepare a budget for production of 6,000, 7,000 and 8,000 Irons, showing distinctly marginal cost and total cost. (*C.A. Inter*)

[**Ans.** Total cost at 6,000 units, ₹ 10,50,000, per unit ₹ 175;
Total cost at 7,000 units ₹ 11,87,500, per unit ₹ 169.64;
Total cost at 8,000 units, ₹ 13,25,000, per unit ₹ 165.63]

5. The monthly budgets for factory overhead of a company for two levels of activity were as follows :

	60%	100%
Budgeted production (units)	600	1,000
	₹	₹
Wages	1,200	2,000
Consumable stores	900	1,500
Maintenance	1,100	1,500
Power and fuel	1,600	2,000
Depreciation	4,000	4,000
Insurance	1,000	1,000
Total	9,800	12,000

You are required to :

(*i*) indicate which of the items are fixed, variable and semi-variable.

(*ii*) prepare a budget for 80% capacity.

(*iii*) find the total cost, both fixed and variable, per unit of output at 80% capacity.

(B.Com. Hons., Delhi)

[**Ans.** Cost per unit at 80%—₹ 13.625]

6. You are required to prepare a sales overhead budget from the following estimates:

	₹
Advertisement	2,500
Salaries of sales department	5,000
Expenses of sales department	1,500
Counter-salesmen's salaries and dearness allowance	6,000

(Commission to counter salesmen at 1% of their sales. Travelling salesmen's commission at 10% on their sales and expenses at 5% on their sales).

The sales during the period were estimated as follows:

	Counter sales ₹	*Travelling salesmen's* ₹
(*i*)	80,000	10,000
(*ii*)	1,20,000	15,000
(*iii*)	1,40,000	20,000

(B.Com. Hons. Delhi; I.C.W.A. Inter)

[**Ans.** Total sales overhead at sales of ₹ 90,000 = ₹ 17,300
Total sales overhead at sales of ₹ 1,35,000 = ₹ 18,450
Total sales overhead at sales of ₹ 1,60,000 = ₹ 19,400]

7. From the following details, prepare a Factory Overhead Budget for 8,000 direct labour hours.

Direct labour hours	6,000	10,000
Factory Overheads:	₹	₹
Indirect materials	12,000	20,000
Indirect labour	9,000	15,000
Depreciation	25,000	25,000
Lighting	3,000	3,000
Supervision	13,200	18,000
Power	3,800	6,000
Maintenance	9,800	15,000

(B.Com., Adapted)

[**Ans.** Total factory overhead for 8,000 direct labour hours = ₹ 88,900]

8. Gemini Steel Ltd. manufactures a single product for which market demand exists for additional quantity. Present sales of ₹ 60,000 per month utilises only 60% capacity of the plant. Marketing Manager assures that with the reduction of 10% in the price, he would be in a position to increase the sale by about 25% to 30%.

The following data are available :

(*i*) Selling price ₹ 10 per unit

(*ii*) Variable cost ₹ 3 per unit

(*iii*) Semi-variable cost ₹ 6,000 fixed + 50 paise per unit

(*iv*) Fixed cost ₹ 20,000 at present level estimated to be ₹ 24,000 at 80% output.

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You are required to prepare the following statements showing :

(*i*) The operating profits at 60%, 70% and 80% levels at current selling price, and

(*ii*) The operating profits at proposed selling price at the above levels. (*B.Com. Hons., Delhi*)

[**Ans.** Profit at current selling prices ₹ 13,000; 19,500 and 22,000; Profit at proposed selling price ₹ 7,000; ₹ 12,500 and 14,000]

9. Goldman Company Limited operates on a system of Flexible Budgets. With the aid of the following information, you are required to prepare Flexible Budget at 80%, 90% and 100% level of activity showing the profits that would result at these levels :

(*i*) The present sale of 8,00,000 units at ₹ 10 each is at the normal level of 80%. If the output is increased to 90%, the selling price will be reduced by 2.5% and ifthe output reached 100%, the original selling price will be reduced by 5% in order to reach a wider market.

(*ii*) The prime cost per unit is ₹ 5, made up of direct materials ₹ 3.50, direct labour ₹ 1.25 and direct expenses ₹ 0.25. If output reaches 90% level of activity and above, a saving of 5% can be effected in the purchase price of raw materials.

(*iii*) Variable overhead—salesmen's commission will be 5% of the sales value.

(*iv*) Semi-variable overhead at normal level of activity are:

	₹
Supervision	80,000
Power	70,000
Heat and light	40,000
Maintenance	50,000
Salesmen expenses	60,000
Indirect labour	1,00,000
Transport costs	2,00,000

These are expected to increase by 5% if output reaches 90% level and by a further 10% if it reaches the 100% level.

(*v*) Fixed overheads are :

	₹
Rent and rates	1,00,000
Depreciation	4,00,000
Advertisement	5,00,000
Administration	7,50,000
Sales department	2,00,000
General	50,000

(*B.Com. Hons., Delhi*)

[**Ans.** Profit at 80% ₹ 10,00,000; at 90% ₹ 13,63,750, at 100% ₹ 15,07,000]

10. From the following data, prepare a flexible budget for production of 40,000 units, 60,000 units and 75,000 units of product *X*, distinctly showing variable and fixed cost as well as total cost. Also indicate element wise cost per unit. Budgeted output and costs per unit are :

Budgeted output	1,00,000 units
	Per unit cost ₹
Direct materials	90
Direct labour	45
Direct variable expenses	10
Manufacturing variable overhead	40
Fixed production overhead	5

Administration overhead (fixed)	5
Selling overhead	10 (10% fixed)
Distribution overhead	15 (20% fixed)

(B.Com. Hons., Delhi)

[**Ans.** Total cost ₹ 96,40,000 at 40,000 units; ₹ 1,37,60,000 at 60,000 units ₹ 1,68,50,000 at 75,000 units]

11. A factory is currently running at 50% capacity and produces 5,000 units at a cost of ₹ 90 per unit as per details below:

Materials	₹ 50	
Labour	15	
Factory Overheads	15	(₹ 6/- fixed)
Administrative Overheads	10	(₹ 5/- fixed)

The current selling price is ₹ 100/- per unit.

At 60% working, material cost per unit increases by 2% and selling price per unit falls by 2%. At 80% working, material cost per unit increases by 5% and selling price per unit falls by 5%.

Estimate profits of the factory at 60% and 80% working and offer your comments.

(I.C.W.A. Inter)

[**Ans.** Profit at 50% ₹ 50,000; At 60% ₹ 53,000; At 80% ₹ 53,000]

(**Comments** By increasing capacity from 50% to 60%, profit increases by ₹ 3,000 to ₹ 53,000. However, by increasing capacity from 60% to 80%, profit remains at ₹ 53,000 because it gets neutralised by increase in cost and reduction in selling price.)

12. Draw a Material Procurement Budget (quantitative) from the following information :

Estimated sales of product 40,000 units.

Each unit of the product requires 3 units of material *A* and 5 units of material *B*.

Estimated opening balance at the commencement of the next year :

Finished product	5,000 units	Materials on order :	
Material *A*	12,000 units	Material *A*	7,000 units
Material *B*	20,000 units	Material *B*	11,000 units

The desirable closing balances at the end of the next year :

Finished product	7,000 units	Materials on order :	
Material *A*	15,000 units	Material *A*	8,000 units
Material *B*	25,000 units	Material *B*	10,000 units

(B.Com., Madurai)

[**Ans.** Production 42,000 finished units. Purchases: A – 1,30,000 units, B – 2,14,000 units]

13. You are producing on alloy. Production of one ton of alloy requires 1.5 tons of Iron and 0.5 ton of zinc. The producer plans to sell 50,000 tons of alloy during the year 2018. Prepare Materials Procurement Budget for the year 2018 from the following :

Balance as on Jan. 1, 2018 :

Stock of Alloy	6,000 tons
Stock of iron ore	12,000 tons
Stock of Zinc	4,000 tons
Iron ore an order	5,000 tons
Zinc on order	3,000 tons

Balance as desired on Dec. 31, 2018 :

Stock of Alloy	5,000 tons

Stock of Iron ore	8,000 tons
Stock of Zinc	3,000 tons
Iron ore on order	7,000 tons
Zinc on order	2,000 tons

(B.Com. Hons. Delhi)

[Ans. Estimated production of alloy — 49,000 tons; Materials to be procured Iron or 71,500 tons; Zinc 22,500 tons]

14. Chennai Engineering Co. Ltd. manufactures two Products *X* and *Y*. An estimate of number of units expected to be sold in the first seven months of 2018 is given below.

	Product X	*Product Y*
January	500	1,400
February	600	1,400
March	800	1,200
April	1,000	1,000
May	1,200	800
June	1,200	800
July	1,000	900

It is anticipated that :

(*a*) there will be no work-in-progress at the end of any month :

(*b*) finished units equal to half the anticipated sales for the next month will be in stock at the end of each month (including December 2017) The budgeted production and production costs for the year ending 31st December 2018 are as follows :

	Product X	*Product Y*
	₹	₹
Production (units)	11,000	12,000
Direct materials per unit	12	19
Direct wages per unit	5	7
Other manufacturing charges apportionable to each type of product	33,000	48,000

You are required to prepare :

(*a*) A production budget showing the number of units to be manufactured each month.

(*b*) A summarised production cost budget for the 6-month period — January to June 2018.

(B.Com., Adapted)

[Ans. Production for six months : *X*—5550 units, *Y*—6350 units
Total cost—*X* ₹ 1,11,000; *Y* ₹ 190,500]

15. A company manufactures two products *A* and *B* by making use of two types of materials *viz. X* and *Y*. Product *A* requires 10 units of *X* and 3 units of *Y*. Product *B* requires 5 units of *X* and 2 units of *Y*. The price of *X* is ₹ 2 per unit and that of *Y* ₹ 3 per unit.

The sales manager has estimated the sales of product *A* to be 5,000 units and that of product *B* 10,000 units. The estimated opening stock of material *X* for the budget period is 2,500 units and that of *Y* is 3,000 units. The desired closing stock of material *X* is 5,000 units and that of *Y* is 4,000 units.

Prepare the Material Usage Budget and Materials Purchase Budget for the year ending 31st Dec., 2011

(B.Com. Adapted)

[Ans. Budgeted usage in units: *X*–1,00,000, *Y*–35,000;
Units to be purchased: *X* 1,02,500, *Y*–36,000;
Purchase cost of *X*–₹ 2,05,000, *Y*–₹ 1,08,000]

16. A company is expecting to have ₹ 35,000 cash in hand on 1st April, 2018 and it requires you to prepare a budget for three months, April to June, 2018. The following information is supplied to you:

	Sales ₹	*Purchase* ₹	*Wages* ₹	*Expenses* ₹
February	70,000	40,000	8,000	6,000
March	80,000	50,000	8,000	7,000
April	92,000	52,000	9,000	7,000
May1,00,000	60,000	10,000	8,000	
June	1,20,000	55,000	12,000	9,000

Other information:

(*a*) Period of credit allowed by suppliers: two months;

(*b*) 25% of the sales are for cash and period of credit allowed to customers for credit sales one month.

(*c*) Delay in payment of wages and expenses: one month;

(*d*) Income Tax of ₹ 20,000 is to be paid in June 2018.

(B. Com., Kerala)

[Ans. Balance on 30th June ₹ 1,06,000]

17. From the following forecasts of income and expenditure, you are required to prepare a cash budget of three months ending 30th November. The bank balance on 1st September was ₹ 10,000.

Month	*Sales* ₹	*Purchases* ₹	*Wages* ₹	*Factory expenses* ₹	*Office expenses* ₹
July	80,000	40,000	5,600	3,900	10,000
August	76,500	42,000	5,800	4,100	12,000
September	78,000	38,500	5,800	4,200	14,000
October	90,000	37,500	5,900	5,100	16,000
November	95,000	43,000	5,900	6,000	13,000

A sales commission of 4% on sales, due in the month following the month in which the sales dues are collected, is payable in addition to office expenses. Fixed assets worth ₹ 65,000 will be purchased in September to be paid for in the following month. ₹ 20,000 in respect of debenture interest will be paid in October. The period of credit allowed to customers is two months and one month credit is obtained from suppliers of goods. Wages are paid on an average fortnightly on 1 and 16 of each month in respect of dues for period ending on the date preceding such days. Expenses are paid in the month in which they are due. *(B.Com. Adapted)*

[Ans. Cash balance 30 Sept. ₹ 24,000,
31 Oct. ₹ (–) 53,150; 30 Nov. ₹ (–) 40,610]

18. A company expects to have ₹ 37,500 cash in hand on 1st April, and requires you to prepare an estimate of cash position during the three months–April, May and June. The following information is supplied to you :

	Sales ₹	*Purchases* ₹	*Wages* ₹	*Factory expenses* ₹	*Office expenses* ₹	*Selling expenses* ₹
February	75,000	45,000	9,000	7,500	6,000	4,500
March	84,000	48,000	9,750	8,250	6,000	4,500
April	90,000	52,500	10,500	9,000	6,000	5,250
May	1,20,000	60,000	13,500	11,250	6,000	6,570
June	1,35,000	60,000	14,250	14,000	7,000	7,000

Other informations :

1. Period of credit allowed by suppliers 2 months.
2. 20% of sales are for cash and period of credit allowed to customers for credit is one month.
3. Delay in payment of all expenses—1 month.
4. Income tax of ₹ 57,500 is due to be paid on June 15th.
5. The company is to pay dividends to shareholders and bonus to workers of ₹ 15,000 and ₹ 22,500 respectively in the month of April.
6. Plant has been ordered to be received and paid in May. It will cost ₹ 1,20,000.

(*B.Com., Madurai*)

[**Ans.** Cash balance 30th April ₹ 11,700; Cash shortage on 31st May ₹ 91,050; Cash shortage on 30th June ₹ 1,15,370]

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CHAPTER 3

STANDARD COSTING AND VARIANCE ANALYSIS

CHAPTER OUTLINE

Introduction; Meaning and definition of standard cost and standard costing; Applicability; Standard cost and estimated cost; Standard costing and budgetary control; Advantages; Limitations; Prelimineries; Variance analysis; Material variances; Labour variances; Overhead variances; Sales variances; Disposition of variances; Control ratios; Summary of formulae; Problems and solutions; Key terms; Examination questions.

Introduction

Standard costing is a specialised technique of cost accounting to control the cost. From cost control point of view, 'what a product should have costed' is more important than 'What it did actually cost'. The actual cost is the past cost or historical cost and historical costing is a system in which actual costs incurred in the past are ascertained.

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Limitations of Historical Costing

Ascertainment of actual costs does not serve any useful purpose and has certain limitations.

Firstly, such costs are obtained too late and cannot be used for price quotations.

Secondly, historical costs do not serve the purpose of cost control because the cost has already been incurred before cost figures are available for managerial control.

Thirdly, historical costs do not provide any yardstick against which efficiency can be measured.

These limitations encouraged the development of a more satisfactory standard costing approach based on predetermined costs. Standard costing is not a method of costing like job order on process costing. It is a special technique to control costs and can be used in conjunction with any other system like job costing, process costing or marginal costing, etc.

Standard costing is one of the most important tools to control costs. In this technique, all costs are pre-determined, *i.e.*, costs are determined in advance of production. Such pre-determined costs are then compared with the actual costs. The difference between the actual costs and pre-determined costs, known as variances, are then analysed and investigated to know their reasons. Variances are reported to management for taking remedial steps so that actual costs adhere to pre-determined or standard costs.

Meaning and Definition of Standard Cost

The word standard means *'a norm'* or a criterion. Standard cost is thus a criterion cost which may be used as a yardstick to measure the efficiency with which actual cost has been incurred. In other words, standard costs are pre-determined costs or target costs that should be incurred under efficient operating conditions.

According to Chartered Institute of Management Accountants (C.I.M.A.), London, *"Standard cost is the pre-determined cost based on technical estimates for materials, labour and overhead for a selected period of time for a prescribed set of working conditions".*

In the words of Brown and Howard, *"the standard cost is a predetermined cost which determines what each product or service should cost under given circumstances".* Thus standard costs are planned costs that should be attained under a given set of operating conditions. The main object of standard cost is to look forward and assess what the cost *'should be'* as distinct from what the cost has been in the past.

Meaning and Definition of Standard Costing

Standard costing is simply the name given to a technique whereby standard costs are computed and subsequently compared with the actual costs to find out the differences between the two. These differences (known as variances) are then analysed to know the causes thereof so as to provide a basis of control. The C.I.M.A. London has defined standard costing as *"the preparation of standard costs and applying them to measure the variations from actual costs and analysing the courses of variations with a view to maintain maximum efficiency in production".* Brown and Howard have defined it, *"as a technique of cost accounting which compares the standard cost of each product or service with the actual costs, to determine the efficiency of the operations so that any remedial action may be taken immediately".*

Steps. Standard costing system involves the following steps :

1. The setting of standard costs for different elements of cost, *i.e.*, material, labour and overheads.
2. Ascertaining actual costs.
3. Comparing standard with actual costs to determine the differences between the two, known as 'variances'.
4. Analysing variances for ascertaining reasons thereof.
5. Reporting of these variances and analysis thereof to management for appropriate corrective action, where necessary.

Applicability of Standard Costing

The application of standard costing requires certain conditions to be fulfilled. These are :

(*a*) A sufficient volume of standard products or components should be produced.

(*b*) Methods, operations and processes should be capable of being standardised.

(*c*) A sufficient number of costs should be capable of being controlled.

Industries producing standardised products which are repetitive in nature, *i.e.*, industries using process costing method, fulfil all the above conditions and thus the system can be used to the best advantage in such industries. Examples are fertilisers, cement, steel, sugar, etc.

In jobbing industries, it is not worthwhile to develop and employ a full system of standard costing. This is because in such industries each job undertaken may be different from another and setting standards for each job may prove difficult and expensive. In such industries, therefore,

a partial system may be adopted in appropriate circumstances. For example, certain processes and operations performed may be of a repetitive nature and thus the principles of standard costing may be applied by setting standard for each such process or operation.

Standard Costs and Estimated Costs – Comparison

Both standard costs and estimated costs are predetermined costs computed in advance of production. But their objectives are normally different. The differences between the two are summarised as under :

Basis	*Standard cost*	*Estimated cost*
1. **Aim.**	Standard cost aims at what the cost SHOULD be.	Estimated cost is an assessment of what the cost WILL be.
2. **Basis.**	Standard costs are planned costs which are determined on a scientific basis after taking into account certain level of efficiency.	Estimated costs are based on average of the past figures, taking into consideration anticipated changes in future.
3. **Relation to accounts.**	In standard costing system, standard costs are usually incorporated into the accounts, from which variances of actual from standard are ascertained.	Estimated costs are used as statistical data for comparing with actual figures. Such costs are not entered in the books of accounts.
4. **Use.**	Standard costs are meant to be used for a concern operating on a standard costing system.	Estimated costs may be used in any concern operating on a historical cost system.
5. **Purpose.**	Standard costs serve the purpose of cost control.	Estimated costs do not serve the purpose of cost control. Such costs serve other purposes, like quoting selling price of new products, decision to buy or manufacture, etc.

Standard Costing and Budgetary Control — Comparison

Standard costing and budgetary control have the common objective of cost control by establishing predetermined targets. The actual performances are measured and compared with the predetermined targets for control purposes. Both the techniques are of importance in their respective fields and are complementary to each other.

Points of Similarity

There are certain basic principles which are common to both standard costing and budgetary control. These are :

1. The establishment of predetermined targets of performance.
2. The measurement of actual performance.
3. The comparison of actual performance with the predetermined targets.
4. The analysis of variances between the actual and the standard performance.
5. To take cormrective measures, where necessary.

Points of Difference

In spite of so much similarity between standard costing and budgetary control, there are some important differences between the two, which are as follows :

Basis	Standard costing	Budgetary control
1. **Scope.**	Standard costs are developed mainly for the manufacturing function and sometimes also for marketing and administration functions.	Budgets are compiled for different functions of the business such as sales, purchases, production, cash, capital expenditure, research and development, etc.
2. **Intensity.**	Standard costing is intensive in application as it calls for detailed analysis of variances.	Budgetary control is extensive in nature and the intensity of analysis tends to be much less than that in standard costing.
3. **Relation to accounts.**	In standard costing, variances are usually re-vealed through accounts.	In budgetary control, variances are normally not revealed through accounts and control is exercised by statistically putting budgets and actuals side by side.
4. **Usefulness.**	Standard costs represent realistic yardsticks and, are therefore, more useful for controlling and reducing costs.	Budgets usually represent an upper limit on spending without considering the effectiveness of the expenditure in terms of output.
5. **Basis.**	Standard costs are usually established after considering such vital matters as production capacity, methods employed and other factors which require attention when determining an acceptable level of efficiency.	Budgets may be based on previous year's costs without any attention being paid to efficiency.
6. **Projection.**	Standard cost is a projection of cost accounts.	Budget is a projection of financial accounts.

ADVANTAGES OF STANDARD COSTING

The advantages to be derived from a system of standard costing will vary from one business to another. Much depends upon the degree of sophistication achieved and the acceptance by the management of utility of the system. Possible advantages are as follows :

1. **Effective cost control.** The most important advantage of standard costing is that it facilitates the control of costs. Control is exercised by comparing actual performance with standards and taking action on the basis of variances so revealed.

2. **Helps in planning.** Establishing standards is a very useful exercise in business planning which instils in management a habit of thinking in advance.

3. **Provides incentives.** Standards provide incentives and motivation to work with greater effort. Schemes may be formulated to reward those who achieve or surpass the standard. This increases efficiency and productivity.

4. **Fixing prices and formulating policies.** Standard costs are a valuable aid to management in determining prices and formulating production policies. For example, prices may be fixed by adding a standard margin of profit to standard cost. Similarly, standard costing furnishes cost estimates while planning production of new products.

5. **Facilitates delegation of authority.** In order that responsibility for off-standard performance may be identified directly with the persons concerned, an organisation chart is prepared which shows delegated authority and establishes responsibility of each executive.

6. **Facilitates coordination.** While establishing standards, the performance of different departments such as production, sales, purchases etc. is taken into account. Thus through the working of standard cost system, coordination of various functions is achieved.

7. **Eliminates wastes.** By fixing standard, certain waste such as material wastage, idle time, lost machine hours, etc. are reduced,

8. **Valuation of stocks.** Standard costing simplifies the valuation of stock because the stock is valued at standard cost. The difference between standard and actual cost is transferred to a variance account. This ensures uniform pricing of stocks in the form of raw materials, work-in-progress and finished goods.

9. **Management by exception.** Reporting of variances is based on the principle of management by exception. Only variances beyond a predetermined limit may be considered by the management for corrective action. This also reduces the cost of preparing reports.

10. **Economical and simple.** Standard costing is an economical and simple means of cost accounting and generally results in savings in the cost of costing system. It results in reduction in paper work in accounting and needs fewer number of forms and records. This leads to considerable saving in clerical labour.

LIMITATIONS OF STANDARD COSTING

Standard costing system may suffer from certain disadvantages. This may be because of lack of education and communication and resultant misunderstanding on the part of managerial staff. Possible disadvantages are :

1. The system may not be appropriate to the business.
2. The staff may not be capable of operating the system.
3. A business may not be able to keep standards up-to-date. In other words, a business may not revise standards to keep pace with the frequent changes in manufacturing conditions. Firms may avoid revising standards as it is a costly affair.
4. Inaccurate and unreliable standards cause misleading results and thus may not enjoy the confidence of the users of the system.
5. Operation of the standard costing system is a costly affair and small firms cannot afford it.
6. Standard costing is expensive and unsuitable in job order industries which are manufacturing non-standardised products.

VARIANCE ANALYSIS

Cost Variance–Difference between standard and actual is known as variance. Cost variance is the *"difference between a standard cost and the comparable actual cost incurred during a period."* C.I.M.A., London.

Variance analysis is the process of analysing variances by sub-dividing the total variance in such a way that management can assign responsibility for any off standard performance. According to C.I.M.A., London, Terminology, variance analysis is *"the process of computing the amount of variance and isolating the causes of variance between actual and standard."* An important aspect of variance analysis is the need to separate controllable from uncontrollable variances. A detailed

analysis of controllable variances will help the management to identify the persons responsible for its occurrence so that corrective action can be taken.

FAVOURABLE AND UNFAVORABLE VARIANCES

Where the actual cost is less than standard cost, it is known as *'favourable'* or *'credit'* variance. On the other hand, where the actual cost is more than standard cost, the difference is referred to as *'unfavourable'*, *'adverse'* or *'debit'* variance.

In other words, any variance that has a favourable effect on profit is favourable variance and any variance which has an adverse or unfavourable effect on profit is unfavourable variance.

Many students experience difficulty in ascertaining whether a variance is favourable or adverse. In the formulae given in this book, positive (+) variance will indicate favourable variance and negative (–) variance will indicate adverse variance. Favourable variances will be designated by (*F*) and Adverse by (*A*).

CONTROLLABLE AND UNCONTROLLABLE VARIANCES

If a variance can be regarded as the responsibility of a particular person, with the result that his degree of efficiency can be reflected in its size, then it is said to be a controllable variance. For example, excess usage of material is usually the responsibility of the foreman concerned. However, if the excessive usage is due to material being defective, the responsibility may rest with the Inspection Department for non-detection of the defects.

If a variance arises due to certain factors beyond the control of management, it is known as uncontrollable variance. For example, change in the market prices of materials, general increase in the labour rates, increase in the rates of power or insurance premium, etc. are not within the control of the management of the company. Responsibility for uncontrollable variances cannot be assigned to any person or department.

The division of variances into controllable and uncontrollable is extremely important. The management should place more emphasis on controllable variance as it is these variances which require investigation and possibly corrective action. The uncontrollable variances, on the other hand, may be ignored. This follows the well known *"principle of exception"* whereby those matters which are going right are ignored and any deviations from efficient performance are investigated.

MATERIAL VARIANCES

Material Cost Variance

This is the difference between the standard cost of direct materials specified for the output achieved and the actual cost of direct materials used. It is calculated as :

$$\text{Material Cost Variance} = \text{Standard cost of actual output} - \text{Actual cost}$$

$$MCV = SC - AC$$

$$\text{Material Cost Variance} = \begin{bmatrix}\text{Standard quantity}\\ \text{for actual output}\end{bmatrix} \times \begin{bmatrix}\text{Standard}\\ \text{price}\end{bmatrix} - \begin{bmatrix}\text{Actual}\\ \text{quantity}\end{bmatrix} \times \begin{bmatrix}\text{Actual}\\ \text{price}\end{bmatrix}$$

$$MCV = (SQ \times SP) - (AQ \times AP)$$

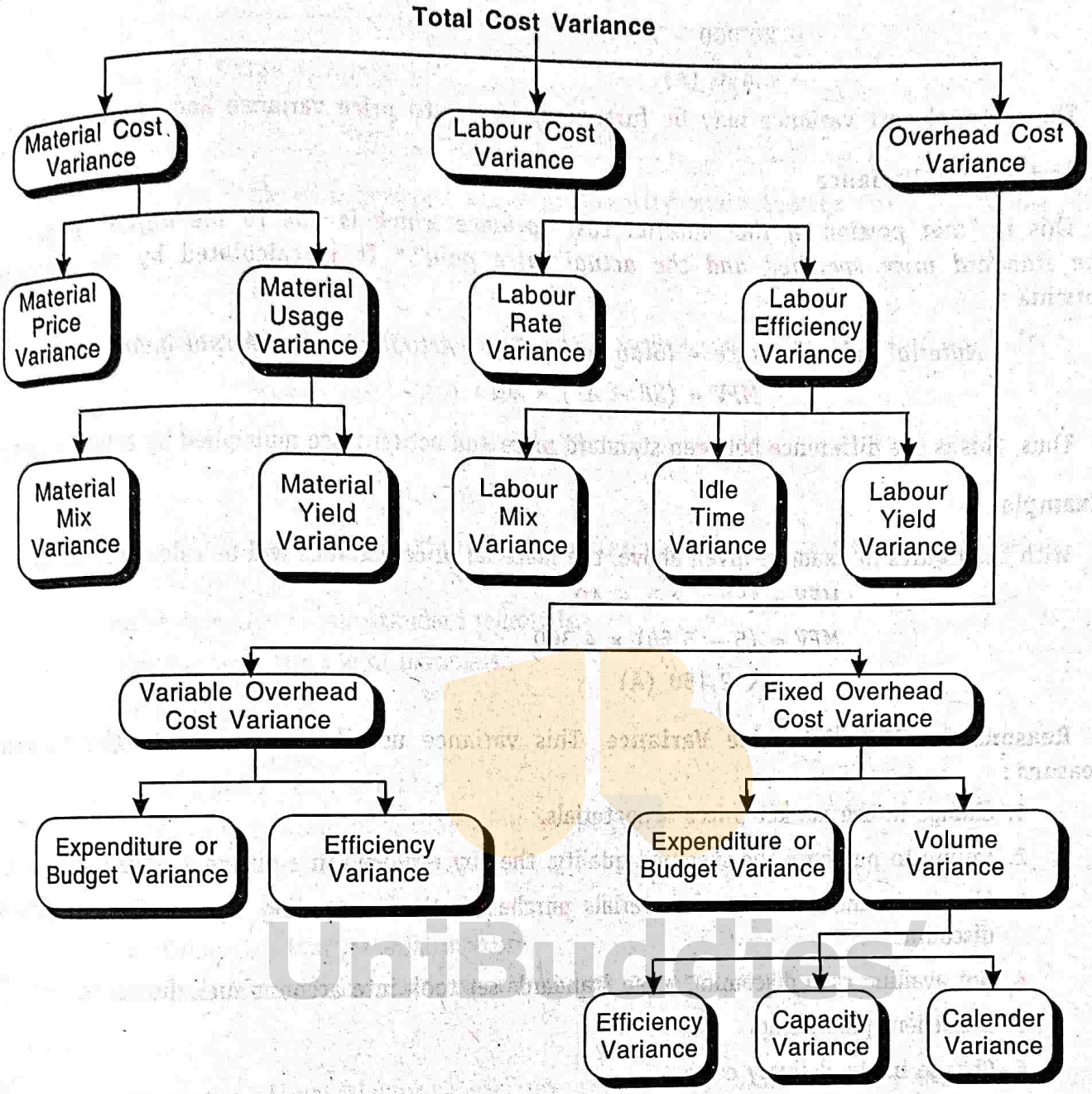

Fig. 3.1 Cost Variance Analysis

Example

A furniture company uses sunmica tops for tables. It provides the following data :

Standard quantity of sunmica per table	4 sq. ft.
Standard price per sq. ft. of sunmica	₹ 5
Actual production of tables	1,000
Sunmica actually used	4,300 sq. ft.
Actual purchase price of sunmica per sq. ft.	₹ 5.50

Material cost variance will be calculated as under :

$$MCV = (SQ \times SP) - (AQ \times AP)$$

$$MCV = (1{,}000 \times 4 \times ₹\ 5) - (4{,}300 \times ₹\ 5.50)$$

= 20,000 – 23,650

= 3,650 (A)

The material cost variance may be further divided into price variance and usage variance.

Material Price Variance

This is *"that portion of the material cost variance which is due to the difference between the standard price specified and the actual price paid".** It is calculated by the following formula :

$$\textit{Material Price Variance} = (\textit{Standard price} - \textit{Actual price}) \times \textit{Actual quantity}$$

$$MPV = (SP - AP) \times AQ$$

Thus, this is the difference between standard price and actual price multiplied by actual quantity.

Example

With the figures in Example given above, the material price variance will be calculated as follows :

$$MPV = (SP - AP) \times AQ$$

$$MPV = (5 - 5.50) \times 4{,}300$$

= ₹ 2,150 (A)

Reasons for Material price Variance. This variance usually arises due to the following reasons :

1. Change in the market prices of materials.
2. Failure to purchase the specified quality, thereby resulting in a different price being paid.
3. Change in the quantity of materials purchased, thereby leading to lower/higher quantity discount.
4. Not availing cash discounts, when standards set took into account such discounts.
5. Inefficient purchasing.
6. Change in the delivery costs.
7. Rush purchases.
8. Purchase of a substitute material on account of non-availability of the material specified.
9. Change in the rates of excise duty, purchase tax, etc.
10. Off-season purchasing for certain seasonal products like jute, cotton, etc.

Material Usage (or Quantity) Variance

This is *"that portion of the material cost variance which is due to the difference between the standard quantity specified and the actual quantity used".* Its formula is :

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* C.I.M.A., London Terminology

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$$\text{Material Usage Variance} = \left[\begin{matrix}\text{Standard quantity} \\ \text{for actual output}\end{matrix} - \begin{matrix}\text{Actual} \\ \text{quantity}\end{matrix}\right] \times \begin{matrix}\text{Standard} \\ \text{price}\end{matrix}$$

$$MUV = (SQ - AQ) \times SP$$

Thus, this is the difference between standard quantity and actual quantity multiplied by the standard price.

Example

Continuing example given above, material usage variance will be calculated as under :

$$MUV = (SQ - AQ) \times SP$$
$$= (4,000 - 4,300) \times 5$$
$$= ₹\ 1,500\ (A)$$

Reasons for Material Usage Variance. The material usage variance may be caused by some or all of the following reasons :

1. Use of defective or sub-standard materials.
2. Carelessness in the use of materials.
3. Pilferage.
4. Poor workmanship.
5. Defect in plant and machinery.
6. Change in the design or specification of the product.
7. Change in the quality of materials.
8. Use of substitute materials.
9. Use of non-standard material mixture.
10. Yield from materials in excess of or less than standard yield.

Check

The algebraic sum of material price variance and material usage variance should be equal to material cost variance. Thus :

$$MCV = MPV + MUV$$
$$3,650\ (A) = ₹\ 2,150\ (A) + ₹\ 1,500\ (A)$$

Figure 3.2 shows the graphic analysis of material variances which has been prepared with the figures of the above example. In this chart, the solid lines rectangle indicates the standard cost (4,000 × ₹ 5) and the dotted rectangle shows the actual cost (4,300 × ₹ 5.50).

$$MPV = (₹\ 5 - ₹\ 5.50) \times 4,300 \quad = ₹\ 2,150\ (A)$$
$$MUV = (4,000 - 4,300) \times ₹\ 5 \quad = ₹\ 1,500\ (A)$$

The difference between the areas of standard cost rectangle and the actual cost rectangle i.e. shaded area represents material cost variance, which has been analysed into material price variance and material usage variance. The variances are adverse because the actual cost rectangle is larger in size than the standard cost rectangle.

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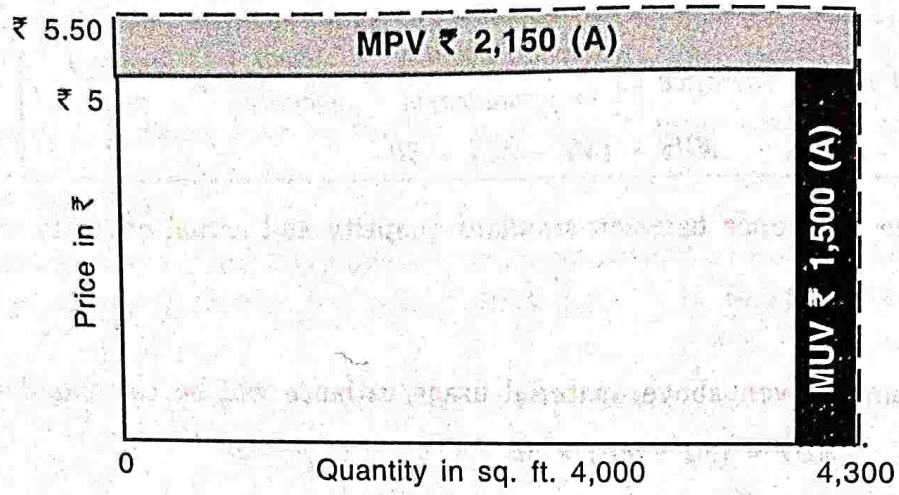

Fig. 3.2 Analysis of Material Cost Variance.

Illustration 3.1

The standard cost card shows the following details relating to material needed to produce 1 kg. of groundnut oil :—

Quantity of groundnut required	3 kg.
Price of groundnut	₹ 2.50 per kg.
Actual production data :	
Production during the month	1,000 kg.
Quantity of material used	3,500 kg.
Price of groundnut	₹ 3 per kg.

Calculate : (*a*) Material Cost Variance (*b*) Material Price Variance (*c*) Material Usage Variance. *(B.Com. Calicut)*

Solution

Basic Data

Standard Quantity (SQ)	= 1,000 kg. of production × 3 kg. = 3,000 kg.
Standard Price (SP)	= ₹ 2.50 per kg.
Actual quantity (AQ)	= 3,500 kg.
Actual price (AP)	= ₹ 3 per kg.

Calculation of Variances

(*a*) **Material Cost Variance** = *SC* – *AC*
= (*SQ* × *SP*) – (*AQ* × *AP*)
= (3,000 × 2.50) – (3,500 × 3) = **₹ 3,000 (A)**

(*b*) **Material Price Variance** = (*SP* – *AP*) × *AQ*
= (2.50 – 3) × 3,500 = **₹ 1,750 (A)**

(*c*) **Material Usage Variance** = (*SQ* – *AQ*) × *SP*
= (3,000 - 3,500) × 2.50 = **₹ 1,250(A)**

Check

Material Cost Variance = Price Variance + Usage Variance
3,000 (A) = 1,750 (A) + 1,250(A)

Classification of Material Usages Variance

Material usage variance is further sub-divided into :

(*a*) Material mix variance

(*b*) Material yield variance. (Or Material sub-usage variance)

Material Mix Variance

This is sub-variance of material usage variance. It arises only where more than one type of material is used for producing the finished product. A company may be using a mixture of materials which does not comply with the predetermined standard mixture. This gives rise to material mix variance.

The material mix variance is defined as *that portion of the material usage variance which is due to the difference between standard and actual composition of materials.* It may arise in industries like chemicals, rubber, etc. where a number of raw materials are mixed to produce a final product. Change from the standard mix may be due to non-availability of one or more components of the mix or due to non-purchase of materials at proper time. Increase in the proportion of cheaper materials results in favourable mix variance and vice versa, the use of more expensive materials in larger proportion results in adverse variance.

This variance is calculated with the help of the following formula :

$$\text{Material mix variance} = \left(\begin{matrix}\text{Revised standard} \\ \text{quantity}\end{matrix} - \begin{matrix}\text{Actual} \\ \text{quantity}\end{matrix}\right) \times \begin{matrix}\text{Standard} \\ \text{price}\end{matrix}$$

$$MMV = (RSQ - AQ) \times SP$$

The revised standard quantity is nothing but the standard proportion of total of actual quantities of all the materials. This is calculated as under :

$$RSQ = \frac{\text{Standard quantity of one material}}{\text{Total of standard quantities of all materials}} \times \begin{matrix}\text{Total of actual quantities} \\ \text{of all materials}\end{matrix}$$

Illustration 3.2

From the following data, calculate material mix variance. Also calculate price and usage variances.

Raw material	*Standard*	*Actual*
X	40 units @ ₹ 50 per unit	50 units @ ₹ 50 per unit
Y	60 units @ ₹ 40 per unit	60 units @ ₹ 45 per unit
Total	100 units	110 units

Solution

Calculation of Revised Standard Quantity (*RSQ*).

$$RSQ \text{ of } X = \frac{40}{100} \times 110 = 44 \text{ units}$$

$$RSQ \text{ of } Y = \frac{60}{100} \times 110 = 66 \text{ units}$$

Material Mix Variance	$= (RSQ - AQ) \times SP$	
Material X	$= (44 - 50) \times 50$	$= ₹300$ (A)
Material Y	$= (66 - 60) \times 40$	$= ₹240$ (F)
	MMV	$= ₹60$ (A)
Material Price Variance	$= (SP - AP) \times AQ$	
Material Y	$= (50 - 50) \times 50$	= Nil
Material Y	$= (40 - 45) \times 60$	$= ₹300$ (A)
	MPV	$= ₹300$ (A)
Material Usage Variance	$= (SQ - AQ) \times SP$	
Material X	$= (40 - 50) \times 50$	$= ₹500$ (A)
Material Y	$= (60 - 60) \times 40$	= Nil
	MUV	$= ₹500$ (A)

Material Sub-usage (or Material Revised Usage) Variance

This is a sub-variance of the material usage variance and represents that portion of the material usage variance which is attributed to reasons other than those which give rise to material mix variance. Thus the algebraic sum of this revised usage variance and material mix variance is equal to material usage variance. Its formula is :

$$\text{Material revised usage variance} = \left(\text{Standard quantity} - \text{Revised standard quantity}\right) \times \text{Standard price}$$

$$MRUV = (SQ - RSQ) \times SP$$

In Illustration 3.2 material revised usage variance is calculated as follows :

$MRUV$	$= (SQ - RSQ) \times SP$	
X	$= (40 - 44) \times 50$	$= ₹\ 200$ (A)
Y	$= (60 - 66) \times 40$	$= ₹\ 240$ (A)
	$MRUV$	$= ₹\ 440$ (A)

Check

$$MUV = MMV + MRUV$$

$$500(A) = 60\ (A) + 440\ (A)$$

Material Yield Variance

This is also a sub-variance of material usage variance. It arises in process industries, like chemicals, where loss of materials in production is inevitable. While setting standards, the normal or standard loss is taken into account. But actual loss may differ from normal or standard loss. This results in actual yield or output being different from standard yield.

Thus material yield variance is that portion of the material usage variance which is due to the difference between standard yield specified and actual yield obtained. The standard yield is the output expected to be obtained from the actual usage of raw materials. It should be noted that yield variance as used in standard costing is the same thing as abnormal loss or abnormal gain in the other costing systems.

One important feature of yield variance which differentiates it from other material variances (price, usage and mix variances) is that yield variance is an output variance while others are input variances. In other words, yield variance represents a gain or loss on output in terms of finished production, while other variances represent a gain or loss on the cost of material input. Its formula is as follows :

$$\text{Material Yield Variance} = \left(\text{Actual yield} - \text{Standard yield}\right) \times \text{Standard output price}$$

$$MYV = (AY - SY) \times SOP$$

Standard output price (*SOP*) is the standard material cost per unit of output.

Illustration 3.3

During the month of May, the following data applies:

Raw material	Standard mix			Actual mix		
	Units Kg.	Price ₹	Amount ₹	Units Kg.	Price ₹	Amount ₹
X	60	25	1,500	56	25	1,400
Y	40	50	2,000	44	50	2,200
Total	100		3,500	100		3,600
Less: Loss	30			26		
Yield	70			74		

The standard loss is 30%. Calculate:

(*a*) Material yield variance (*b*) Material mix variance.

Solution

(*a*) **Material Yield Variance** = $(AY - SY) \times SOP$

$MYV = (74 - 70) \times 50^* =$ **₹ 200 (F)**

*Standard material cost per unit of output is calculated as follows :

$$SOP = \frac{\text{Standard material cost}}{\text{Standard output}} = \frac{₹\ 3,500}{70} = ₹\ 50$$

(*b*) **Material Mix Variance** = $(RSQ - AQ) \times SP$

Material *X* = $(60 - 56) \times 25$ = ₹ 100 (F)

Material *Y* = $(40 - 44) \times 50$ = ₹ 200 (A)

MMV = **₹100 (A)**

Note. In this case, standard quantity and revised standard quantity (RSQ) is the same because total actual quantity of all the materials and total standard quantity is the same, *i.e.*, 100 units.

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Illustration 3.4

The standard mix to produce one unit of product is as follows:

Material *A*	60 units @ ₹ 15 per unit	= 900
Material *B*	80 units @ ₹ 20 per unit	= 1,600
Material *C*	100 units @ ₹ 25 per unit	= 2,500
	240 units	5,000

During the month of July, 10 units were actually produced and consumption was as follows:

Material *A*	640 units @ ₹ 17.50 per unit	= 11,200
Material *B*	950 units @ ₹ 18.00 per unit	= 17,100
Material *C*	870 units @ ₹ 27.50 per unit	= 23,925
	2460 units	52,225

Calculate all material variances. *(B.Com. Hons. Delhi Adapted, BBM, Bangalore)*

Solution

Material	*Standard for 10 units*			*Actual for 10 units*		
	Qty. units	*Rate* ₹	*Amt.* ₹	*Qty. Units*	*Rate* ₹	*Amt.* ₹
A	600	15	9,000	640	17.50	11,200
B	800	20	16,000	950	18.00	17,100
C	1,000	25	25,000	870	27.50	23,925
Total	2,400		50,000	2,460		52,225

1. Material Cost Variance = Standard cost – Actual cost
= ₹ 50,000 – ₹ 52,225 (A)
MCV = **₹ 2,225(A)**

2. Material Price Variance = (St. Price – Actual Price) × Actual Qty.

Material *A*	= (15 – 17.50) × 640	= ₹1,600 (A)
Material *B*	= (20 – 18) × 950	= ₹1,900 (F)
Material *C*	= (25 – 27.50) × 870	= ₹2,175 (A)
		MPV = **₹1,875 (A)**

3. Material Usage Variance = (St.Qty. – Actual Qty.) × St. Price

Material *A*	= (600 – 640) × 15	= ₹ 600 (A)
Material *B*	= (800 – 950) × 20	= ₹3,000 (A)
Material *C*	= (1,000 – 870) × 25	= ₹3,250 (F)
		MUV = **₹ 350 (A)**

4. Material Mix Variance = (Revised St. Qty. – Actual Qty.) × St. Price

Material *A*	= (615* – 640) × 15	= ₹ 375 (A)
Material *B*	= (820* – 950) × 20	= ₹2,600 (A)
Material *C*	= (1,025* – 870) × 25	= ₹3,875 (F)
		MMV = **₹ 900 (F)**

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*Revised Standard Quantity (RSQ) is calculated as follows:

Material $A = \frac{2460}{2400} \times 600 = 615$ units

Material $B = \frac{2460}{2400} \times 800 = 820$ units

Material $C = \frac{2460}{2400} \times 1,000 = 1,025$ units

5. Material Yield Variance

For yield variance, certain basic calculations have to be made as follows:

Standard yield $= \frac{\text{Actual usage of materials}}{\text{Standard usage per unit of output}} = \frac{2460}{240} = 10.25$ units

SOP (St. material cost per unit of output) = ₹ 50,000 ÷ 10 units = ₹ 5,000

Material Yield Variance = $(AY - SY) \times SOP$

$MYV = (10 - 10.25) \times 5,000 =$ **₹ 1,250(A)**

Material Revised Usage (or Sub-usage) Variance (MRUV)

= (Standard Quantity – Revised Standard Quantity) × Standard Price

Material $A = (600 - 615) \times 15$ = ₹ 225(A)

Material $B = (800 - 820) \times 20$ = ₹ 400(A)

Material $C = (1,000 - 1,025) \times 25$ = ₹ 625(A)

$MRUV =$ **₹1,250(A)**

Note. Either MYV or MRUV is calculated. These two are always equal.

Check

(*i*) $MUV = MMV + MYV$ (Or *MRUV*)

₹ 350 (A) = ₹ 900 (F) + ₹ 1,250 (A)

or

(*ii*) $MCV = MPV + MMV + MYV$ (Or *MRUV*)

₹ 2,225 (A) = ₹ 1,875 (A) + ₹ 900 (F) + ₹ 1,250 (A)

LABOUR VARIANCES

The analysis and computation of labour variances is quite similar to material variances.

Labour Cost Variance

This is the difference between the standard direct labour cost specified for the activity achieved and the actual direct labour cost incurred. It is calculated as under:

$$\text{Labour Cost Variance} = \text{St. labour cost of actual output} - \text{Actual labour cost}$$

$$LCV = SC - AC$$

Or,

$$\text{Labour Cost Variance} = \left(\text{St. hours for actual output} \times \text{St. rate per hour}\right) - \left(\text{Actual hours} \times \text{Actual rate per hour}\right)$$

$$LCV = (SH \times SR) - (AH \times AR)$$

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Example

The following information is given :

Standard hours per unit	15
Standard rate	₹ 4 per hour
Actual data:	
Actual production	1,000 units
Actual hours	15,300 hours
Actual rate	₹ 3.90 per hour

Calculate labour cost variance.

Solution

Labour Cost Variance = (*SH for actual output* × *SR*) − (*AH* × *AR*)

= (1,000 × 15 × 4) − (15,300 × 3.90)

LCV = **₹ 330 (F)**

Labour cost variance is further divided into rate variance and efficiency variance.

Labour Rate Variance

This is that portion of the labour cost variance which is due to the difference between the standard rate specified and the actual rate paid. Its formula is :

Labour Rate Variance = (*Standard rate* − *Actual rate*) × *Actual hours*

LRV = (*SR* − *AR*) × *AH*

Thus this is the difference between standard and actual rates of wages, multiplied by actual hours.

Example

Using the data given in above example :

LRV = (*SR* − *AR*) × *AH*

= (4 − 3.90) × 15,300 = ₹ 1,530 (F)

Reasons for labour rate variance. Usual reasons are :

1. Change in the basic wage rates.
2. Use of a different method of wage payment.
3. Employing workers of grades different from the standard grades specified.
4. Unscheduled overtime.
5. New workers not being paid at full rates.

Often, labour rate variance will be an uncontrollable variance as labour rates are usually determined by demand and supply conditions in the labour market, backed by negotiable strength of the trade union. Where this variance is due to the use of a grade of labour other than that specified, there may well be such acceptable explanations as non-availability of the labour grade specified. But when a foreman carelessly employs a wrong grade of labour on a job, he may be held responsible.

Labour Time (or Efficiency) Variance

This is that portion of the labour cost variance which is due to the difference between labour hours specified for actual output and the actual labour hours expended. This variance is calculated as follows :

$$\text{Labour Efficiency Variance} = \left(\begin{matrix}\text{St. hours for}\\ \text{actual output}\end{matrix} - \begin{matrix}\text{Actual}\\ \text{hours}\end{matrix}\right) \times \text{Standard rate}$$

$$LEV = (SH - AH) \times SR$$

Thus this variance is the difference between standard and actual time valued at standard rate.

Example

Using the data given in above example

$$LEV = (SH \text{ for actual output} - AH) \times SR$$
$$= (15{,}000 - 15{,}300) \times 4 = ₹\ 1{,}200\ (A)$$

The total of labour rate variance and labour efficiency variance is equal to labour cost variance. Thus :

$$LCV = LRV + LEV$$
$$₹\ 330\ (F) = ₹\ 1{,}530\ (F) + ₹\ 1{,}200\ (A).$$

Reasons for labour efficiency variance. This variance is usually caused by one or more of the following reasons :

1. Poor working conditions, *e.g.*, inadequate lighting and ventilation, excessive heating, etc.
2. Defective tools and plant and machinery.
3. Inefficient workers.
4. Incompetent supervision.
5. Use of defective or non-standard materials.
6. Time wasted by factors like waiting for materials, tools or machine break-down, etc.
7. Insufficient training of workers.
8. Change in the method of operation.
9. Non-standard grade of workers.

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Classification of Labour Efficiency Variance

Labour efficiency variance is further divided into the following sub-variances.

(*a*) Idle time variance
(*b*) Labour mix variance
(*c*) Labour Yield Variance (or Labour revised-efficiency variance)

Idle Time Variance

This variance represents that portion of the labour efficiency variance which is due to abnormal idle time, such as time lost due to machine break-down, power failure, strike, etc. It is calculated by valuing idle hours at standard rate. Thus:

$$\text{Idle Time Variance} = \text{Idle hours} \times \text{Standard rate}$$
$$ITV = IH \times SR$$

As idle hours represent a loss, idle time variance is always unfavourable.

Some accountants do not treat Idle Time Variance as a part of labour efficiency variance but treat it as a part of labour cost variance.

Example

Using the data give in the above example and further assuming that idle time is 200 hours, then the idle time variance would be:

$$ITV = 200 \times 4 = ₹\ 800\ (A)$$

When idle time variance is treated as a sub-variance of labour cost variance and not of labour efficiency variance, then for labour efficiency variance, the actual time would be 15,300 – 200 = 15,100 hours. Labour efficiency variance will be calculated on the basis of 15,100 hours. Thus

$$\text{Labour Efficiency Variance} = (SH - AH) \times SR$$
$$= (15{,}000 - 15{,}100) \times 4 = ₹\ 400\ (A)$$

In this case, the total of Labour Rate Variance, Labour Efficiency Variance and Idle Time Variance would be equal to Labour Cost Variance. Thus

$$LCV = LRV + LEV + ITV$$
$$330\ (F) = 1{,}530\ (F) + 400\ (A) + 800\ (A)$$

Labour Mix Variance (Gang Composition Variance)

This variance is similar to material mix variance. It arises only when more than one grade of workers are employed and the composition of actual grade of workers differ from those specified. It is calculated with the help of following formula :

$$\text{Labour Mix Variance} = \left(\begin{matrix}\text{Revised standard}\\ \text{hours}\end{matrix} - \begin{matrix}\text{Actual}\\ \text{hours}\end{matrix}\right) \times \text{Standard rate}$$
$$LMV = (RSH - AH) \times SR$$

Illustration 3.5

Coates India Ltd. manufactures a particular product, the standard direct labour cost of which is ₹ 120 per unit whose manufacture involves the following :

Grade of workers	Hours	Rate ₹	Amount ₹
A	30	2	60
B	20	3	60
	50		120

During a period, 100 units of the product were produced, the actual labour cost of which was as follows :

Grade of workers	Hours	Rate ₹	Amount ₹
A	3,200	1.50	4,800
B	1,900	4.00	7,600
	5,100		12,400

Calculate (*a*) Labour Cost Variance (*b*) Labour Rate Variance
(*c*) Labour Efficiency Variance (*d*) Labour Mix Variance.

Solution

Grade of worker	Standard for 100 units			Actual for 100 units		
	Hours	Rate ₹	Amt. ₹	Hours	Rate ₹	Amt. ₹
A	3,000	2	6,000	3,200	1.50	4,800
B	2,000	3	6,000	1.900	4.00	7,600
Total	5,000		12,000	5,100		12,400

(a) **Labour Cost Variance** = $SC - AC$

$LCV = 12,000 - 12,400 = ₹\ 400\ (A)$

(b) **Labour Rate Variance** = $(SR - AR) \times AH$

$A = (2 - 1.50) \times 3,200 = ₹\ 1,600\ (F)$

$B = (3 - 4.00) \times 1,900 = ₹\ 1,900\ (A)$

$LRV = ₹\ 300\ (A)$

(c) **Labour Efficiency Variance** = $(SH - AH) \times SR$

$A = (3,000 - 3,200) \times 2 = ₹\ 400\ (A)$

$B = (2,000 - 1,900) \times 3 = ₹\ 300\ (F)$

$LEV = ₹\ 100\ (A)$

Check $LCV = LRV + LEV$

$400\ (A) = 300(A) + 100(A)$

(d) **Labour Mix Variance** = $(RSH^* - AH) \times SR$

$A = (3,060 - 3,200) \times 2 = ₹\ 280\ (A)$

$B = (2,040 - 1,900) \times 3 = ₹\ 420\ (F)$

$LMV = ₹\ 140\ (F)$

*Calculation of Revised Standard Hours (RSH)

$$RSH = \frac{\text{St. hours of the grade}}{\text{Total st. hours}} \times \text{Total actual hours}$$

Grade $A = \frac{3,000}{5,000} \times 5,100 = 3,060$ hrs. Grade $B = \frac{2,000}{5,000} \times 5,100 = 2,040$ hrs.

Labour Revised Efficiency Variance. (Or Labour Sub-efficiency Variance) This is similar to Material Revised Usage Variance and is a sub-variance of labour efficiency variance. It arises due to factors other than those which give rise to idle time variance and labour mix variance. Thus, this is a residue of labour efficiency variance left after idle time and mix variance have been separated. Its formula is :

$$\text{Labour Revised Efficiency Variance} = \left(\begin{matrix}\text{St. hours for} \\ \text{actual output}\end{matrix} - \begin{matrix}\text{Revised} \\ \text{st. hours}\end{matrix}\right) \times \text{St. rate}$$

$$LREV = (SH - RSH) \times SR$$

Example

Using the data given in Illustration 3.5.

Labour Revised Efficiency Variance = (*SH* – *RSH*) × *SR*

Grade *A* = (3,000 – 3,060) × 2 = ₹120 (A)

Grade *B* = (2,000 – 2,040) × 3 = ₹120 (A)

LREV = **₹240 (A)**

Check

LEV = *LMV* + *LREV*

₹ 100(A) = ₹ 140 (F) + ₹ 240 (A)

Labour Yield Variance. This is quite similar to Material Yield Variance. This variance reveals the effect on labour cost of actual output or yield being more or less than the standard yield. Its formula is:

$$\text{Labour Yield Variance} = \left(\begin{matrix}\text{Actual}\\ \text{yield}\end{matrix} - \begin{matrix}\text{St. yield}\\ \text{from actual input}\end{matrix}\right) \times \begin{matrix}\text{St. labour cost}\\ \text{per unit of output}\end{matrix}$$

Illustration 3.6

Standard output	500 units.
Actual output	450 units.
Standard time	1000 hrs.
Standard rate	₹ 20 per hour.

Calculate Labour Yield Variance

Solution

St. time per unit = 1000 hrs ÷ 500 units = 2 hrs.

St. cost per unit = 2 hrs @ 20 = ₹ 40.

$$\text{Labour Yield Variance} = \left(\begin{matrix}\text{Actual}\\ \text{yield}\end{matrix} - \text{St. yield}\right) \times \begin{matrix}\text{St. cost per unit}\\ \text{of output}\end{matrix}$$

= (450 – 500) × ₹ 40 = **₹ 2,000 (A)**

Illustration 3.7

The standard labour employment and the actual labour engaged in a week for a job are as under :

	Skilled workers	*Semi-skilled workers*	*Unskilled workers*
Standard no. of workers in the gang	32	12	6
Actual no. of workers employed	28	18	4
Standard wage rate per hour	3	2	1
Actual wage rate per hour	4	3	2

During the 40 hours working week, the gang produced 1,800 standard labour hours of work. Calculate :

(*a*) Labour Cost Variance
(*b*) Labour Rate Variance
(*c*) Labour Efficiency Variance
(*d*) Labour Mix Variance
(*e*) Labour Yield Variance

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Solution

Category of workers	Standard			Actual		
	Hrs.*	Rate ₹	Amount ₹	Hrs.*	Rate ₹	Amount ₹
Skilled	1,280	3	3,840	1,120	4	4,480
Semi-skilled	480	2	960	720	3	2,160
Unskilled	240	1	240	160	2	320
	2,000		5,040	2,000		6,960

*Hrs. = No. of workers × 40 hours.

St. cost of actual output $= \frac{₹\ 5,040}{2,000\ \text{hrs}} \times 1,800\ \text{hrs.} = ₹\ 4,536$

Labour Cost Variance = *St. cost of actual output – Actual cost*

LCV = ₹ 4,536 – 6,960 = **₹2,424 (A)**

Labour Rate Variance = $(SR - AR) \times AH$

Skilled = (3 – 4) × 1,120 = ₹ 1,120 (A)

Semi-skilled = (2 – 3) × 720 = ₹ 720 (A)

unskilled = (1 – 2) × 160 = ₹ 160 (A)

LRV = **₹2,000 (A)**

Labour Efficiency Variance= (**SH for actual output – AH*) × SR*

Skilled = (1,152 – 1,120) × 3 = ₹ 96 (F)

Semi-skilled = (432 – 720) × 2 = ₹ 576 (A)

Unskilled = (216 – 260) × 1 = ₹ 56 (F)

LEV = **₹ 424 (A)**

*St. hrs. for actual output are calculated as follows :

Skilled $= \frac{1,800}{2,000} \times 1,280 = 1,152$ hrs.

Semi-skilled $= \frac{1,800}{2,000} \times 480 = 432$ hrs.

Unskilled $= \frac{1,800}{2,000} \times 240 = 216$ hrs.

Labour Mix Variance = *(Revised st. hrs. – AH) × SR.*

Skilled = (1,280 – 1,120) ×3 = ₹ 480 (F)

Semi-skilled = (480 – 720) × 2 = ₹ 480 (A)

Unskilled = (240 – 160) × 1 = ₹ 80 (F)

LMV = **₹ 80 (F)**

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Labour Yield Variance = $\left(\begin{matrix}\text{Actual}\\ \text{output}\end{matrix} - \begin{matrix}\text{St. output for}\\ \text{actual hours}\end{matrix}\right) \times$ *St. rate per hour of work*

$$LYV = (1{,}800 - 2{,}000) \times \frac{5{,}040}{2{,}000} = ₹\ 504\ (A)$$

Check

(*i*) $LCV = LRV + LEV$

₹ 2,424 (A) = ₹ 2,000 (A) + ₹ 424 (A)

(*ii*) $LEV = LMV + LYV$

₹ 424 (A) = ₹ 80 (F) + ₹ 504 (A)

OVERHEAD VARIANCES

Overhead is the aggregate of indirect materials, indirect labour and indirect expenses. Analysis of overhead variances is different from that of direct material and direct labour variances and is considered to be a difficult part of variance analysis. There are mainly two reasons for this difficulty. *Firstly*, standard overhead rate for fixed overhead is difficult to establish because changes in the volume of output will distort this rate even though there is no change in the amount of fixed overhead cost. Generally fixed overhead absorption rate is determined on the basis of normal volume of output. *Secondly*, there is conflicting terminology and different ways of computing overhead variances. Overhead variances may be separately computed for fixed overheads and variable overheads. Then there are two variance, three variance and four variance methods of analysing overhead variances. Moreover, overhead rate may be per hour or per unit of output. All these lead to confusion in overhead variance analysis.

In this book, overhead variances have been classified into fixed and variable overhead variances and then further analysed according to causes.

It is important to understand at the outset that overhead variance is nothing but under or over-absorption of overhead. Certain basic terms used in connection with overhead variances are explained first of all.

Standard Overhead Rate: This overhead absorption rate may be computed per hour as follows :

$$\text{Standard overhead rate (per hour)} = \frac{\text{Budgeted overhead}}{\text{Budgeted hours}}$$

Where overhead variances are separately computed for fixed and variable overheads, separate overhead rates are to be computed for fixed overhead and variable overhead.

Computation of Variances

The following basic calculations should be made before computing variances.

(*a*) *Standard hours for actual output* (*SHAO*). It is required to be calculated when overhead are absorbed on the basis of overhead rate per hour. It is calculated as under :

$$SHAO = \frac{\text{Budgeted hours}}{\text{Budgeted output}} \times \text{Actual output}$$

(b) Absorbed (or Recovered) overhead = St. hrs. for actual output × St. overhead rate per hour

(c) Standard overhead = Actual hours × St. overhead rate per hour

(d) Budgeted overhead = Budgeted hours × St. overhead rate per hour

(e) Actual overhead = Actual hours × Actual overhead rate per hour

Overhead Cost Variance

This is the total overhead variance and can be described as the difference between total standard overhead absorbed and total actual overhead incurred. C.I.M.A., London has defined it as *"the difference between the standard cost of overhead absorbed in the output achieved and the actual overhead cost."* Thus, this variance arises due to the actual overhead incurred differing from the standard overhead absorbed and is simply under or over-absorption of overheads. Its formula is :

Overhead Cost Variance = Absorbed overhead – Actual overhead

$$OCV = \left(\text{St. hours for actual output} \times \text{St. overhead absorption rate}\right) - \text{Actual overhead}$$

Example

Budgeted output	10,000 units.
Budgeted hours	10,000
Budgeted overhead	₹ 20,000
Actual overhead	₹ 22,000
Actual output	12,000 units.

Calculate Overhead Cost Variance (OCV).

Solution

$$\text{St. overhead absorption rate} = \frac{\text{Budgeted overhead}}{\text{Budgeted hours}} = \frac{₹\ 20,000}{10,000 \text{ hrs.}} = ₹\ 2 \text{ per hour}$$

$$\text{St. hours for actual output} = \frac{10,000 \text{ hrs.}}{10,000 \text{ units}} \times 12,000 \text{ units} = 12,000 \text{ hours.}$$

$$OCV = (12,000 \times 2) - ₹\ 22,000$$

$$= ₹\ 2,000 \text{ (F)}$$

Overhead Cost Variance is divided into variable overhead and fixed overhead variances.

VARIABLE OVERHEAD (VO) VARIANCES

Variable Overhead Cost Variance : It may be defined as the difference between absorbed variable overhead and actual variable overhead. Its formula is :

$$\text{Variable Overhead Cost Variance} = \left(\text{St. hours for actual output} \times \text{St. variable overhead rate}\right) - \text{Actual overhead cost}$$

$$VOCV = (\text{Absorbed V.O.} - \text{Actual V.O.})$$

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This variance is sub-divided into the following two variances :

(*a*) **Variable Overhead Expenditure Variance.** This is also known as Spending Variance or Budget Variance. This variance arises due to the difference between standard variable overhead allowed and actual variable overhead incurred. Its formula is:

$$\text{V.O. Expenditure Variance} = \left(\begin{matrix}\text{St. variable}\\ \text{overhead rate}\end{matrix} \times \begin{matrix}\text{Actual}\\ \text{hours}\end{matrix}\right) - \begin{matrix}\text{Actual overhead}\\ \text{cost}\end{matrix}$$

$$= (\text{Standard V.O.} - \text{Actual V.O.})$$

(*b*) **Variable Overhead Efficiency Variance.** This variance arises due to the difference between standard hours allowed for actual output and actual hours. The reasons for this variance are the same which give rise to labour efficiency variance. Its formula is as follows:

$$\text{V.O. Efficiency Variance} = \left(\begin{matrix}\text{St. hours for}\\ \text{actual output}\end{matrix} - \begin{matrix}\text{Actual}\\ \text{hours}\end{matrix}\right) \times \begin{matrix}\text{St. variable}\\ \text{overhead rate}\end{matrix}$$

$$= \text{Absorbed V.O.} - \text{Standard V.O.}$$

Check

$$\text{V.O. Cost Variance} = \begin{matrix}\text{V.O. Expenditure}\\ \text{Variance}\end{matrix} + \begin{matrix}\text{V.O. Efficiency}\\ \text{Variance}\end{matrix}$$

Illustration 3.8

Calculate variable overhead variances from the following :

		Budgeted	*Actual*
Output (units)		20,000	19,000
Hours		5,000	4,500
Overhead –	Fixed	₹ 10,000	10,500
	Variable	₹ 5,000	4,800

Solution

Basic calculations :

(*a*) $\begin{matrix}\text{St. variable}\\ \text{overhead rate}\end{matrix} = \frac{\text{Budgeted overhead}}{\text{Budgeted hours}} = \frac{₹\ 5{,}000}{5{,}000\ \text{hours}} = ₹\ 1\ \text{per hour}$

(*b*) $\begin{matrix}\text{St. hours for actual}\\ \text{output}\end{matrix} = \frac{\text{Budgeted hours}}{\text{Budgeted output}} \times \text{Actual output} = \frac{5{,}000}{20{,}000} \times 19{,}000$

$= \mathbf{4{,}750\ hours.}$

Calculation of Variances

(*a*) **Variable Overhead Cost Variance** $= \left(\begin{matrix}\text{St. hrs. for}\\ \text{actual output}\end{matrix} \times \text{St. rate}\right) - \begin{matrix}\text{Actual variable}\\ \text{overhead}\end{matrix}$

$= (4{,}750 \times 1) - 4{,}800 \qquad = ₹\ \mathbf{50\ (A).}$

(*b*) **Expenditure Variance** $= (\text{Actual hours} \times \text{St. rate}) - \text{Actual variable overhead}$

$= (4{,}500 \times 1) - 4{,}800 \qquad = ₹\ \mathbf{300\ (A).}$

(*c*) **Efficiency Variance** $= \left(\begin{matrix}\text{St. hours for}\\ \text{actual output}\end{matrix} - \begin{matrix}\text{Actual}\\ \text{hours}\end{matrix}\right) \times \text{St. rate}$

$= (4{,}750 - 4{,}500) \times 1 \qquad = ₹\ \mathbf{250\ (F)}$

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Check

V.O. Cost Variance = *Expenditure Variance* + *Efficiency Variance*

50 (A) = 300 (A) + 250 (F).

FIXED OVERHEAD (FO) VARIANCES

Fixed Overhead Cost Variance. It is the difference between standard fixed overhead cost for actual output (or absorbed overhead) and actual fixed overhead. Its formula is :

$$F.O.\ Cost\ Variance = \left(\begin{matrix}St.\ hours\ for \\ actual\ output\end{matrix} \times \begin{matrix}St.\ F.O. \\ rate\end{matrix}\right) - \begin{matrix}Actual \\ fixed\ overhead\end{matrix}$$

$$= Absorbed\ overhead - Actual\ overhead.$$

Fixed overhead cost variance is sub-divided into the following two variances :

(*a*) **Fixed Overhead Expenditure Variance.** This is also known as Spending Variance or Budget Variance. It arises due to the difference between budgeted fixed overhead and actual fixed overhead. Its formula is :

$$\begin{matrix}F.O.\ Expenditure \\ Variance\end{matrix} = \begin{matrix}Budgeted \\ fixed\ overhead\end{matrix} - \begin{matrix}Actual \\ fixed\ overhead\end{matrix}$$

(*b*) **Fixed Overhead Volume Variance.** This variance arises due to the difference between standard output and actual output. It is defined as that portion of overhead variance which arises due to the difference between standard cost of overhead absorbed by actual production and the standard allowance for that output.

$$\begin{matrix}F.O.\ Volume \\ Variance\end{matrix} = \left(\begin{matrix}St.\ hours\ for \\ actual\ output\end{matrix} - \begin{matrix}Budgeted \\ hours\end{matrix}\right) \times St.\ rate$$

$$= Absorbed\ Overhead - Budgeted\ Overhead.$$

Illustration 3.9

Calculate fixed overhead variances in Illustration 3.8.

Solution

Basic calculations :

(*a*) $\begin{matrix}St.\ fixed \\ overhead\ rate\end{matrix} = \frac{Budgeted\ fixed\ overhead}{Budgeted\ hours} = \frac{₹\ 10,000}{5,000\ hrs.} = ₹\ 2$

(*b*) $\begin{matrix}St.\ hours\ for \\ actual\ output\end{matrix} = \frac{Budgeted\ hrs.}{Budgeted\ output} \times Actual\ output$

$$= \frac{5,000}{20,000} \times 19,000 = 4,750\ hrs.$$

Calculation of Variances

(*a*) **Fixed Overhead Cost Variance**

$$= \left(\begin{matrix}St.\ hours\ for \\ actual\ output\end{matrix} \times St.\ rate\right) - \begin{matrix}Actual\ fixed \\ overhead\end{matrix}$$

$$= (4,750 \times 2) - 10,500 = ₹\ 1,000\ (A)$$

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(b) Fixed Overhead Expenditure Variance

$$= \begin{matrix}\text{Budgeted} \\ \text{overhead}\end{matrix} - \begin{matrix}\text{Actual} \\ \text{overhead}\end{matrix}$$

$$= 10,000 - 10,500 \qquad = ₹\ 500\ (A)$$

(c) Fixed Overhead Volume Variance

$$= \left(\begin{matrix}\text{St. hrs. for} \\ \text{actual output}\end{matrix} - \begin{matrix}\text{Budgeted} \\ \text{hours}\end{matrix}\right) \times \text{St. rate}$$

$$= (4,750 - 5,000) \times ₹\ 2 \qquad = ₹\ 500\ (A)$$

Check

$$F.O.\ Cost\ Variance = Expenditure\ Variance + Volume\ Variance$$

$$1,000\ (A) = 500\ (A) + ₹\ 500\ (A)$$

Illustration 3.10

The following data is given:

	Budget	Actual
Production in units	12,500	11,000
Man hours	6,250	5,750
Overhead costs :		
Fixed	12,500	13,000
Variable	50,000	45,000

Calculate overhead variances.

Solution

Basic calculations

$$\text{Standard fixed overhead rate (per hour)} = \frac{₹\ 12,500}{6,250\ \text{hrs.}} = ₹\ 2$$

$$\text{Standard variable overhead rate (per hour)} = \frac{₹\ 50,000}{6,250\ \text{hrs.}} = ₹\ 8$$

$$\text{Standard hours for actual output} = \frac{6,250\ \text{hrs.}}{12,500\ \text{units.}} \times 11,000\ \text{units} = 5,500\ \text{hrs.}$$

Calculation of Variances

(a) Variable Overhead Variances

(i) Variable Overhead Cost Variance

$$VOCV = \left(\begin{matrix}\text{St. hours for} \\ \text{actual output}\end{matrix} \times \begin{matrix}\text{St. overhead} \\ \text{rate}\end{matrix}\right) - \begin{matrix}\text{Actual overhead} \\ \text{cost}\end{matrix}$$

$$= (5,500 \times ₹\ 8) - 45,000 = ₹\ 1,000\ (A)$$

(ii) Overhead Expenditure or Budget Variance (OBV)

$$= Standard\ overhead - Actual\ overhead$$

$$= (Actual\ hrs. \times St.\ rate) - Actual\ overhead\ cost$$

$$= (5,750 \times ₹\ 8) - 45,000$$

$$= 46,000 - 45,000 = ₹\ 1,000\ (F)$$

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(iii) **Overhead Efficiency Variance (OEV)**

$$= \begin{pmatrix} \text{St. hours for actual output} - \text{Actual hours} \end{pmatrix} \times \text{St. overhead rate}$$

$$= (5{,}500 - 5{,}750 \times ₹\ 8 = ₹\ 2{,}000\ (A)$$

Check

$$VOCV = OBV + OEV$$

₹ 1,000 (A) = ₹ 1,000 (F) + ₹ 2,000 (A)

(b) **Fixed Overhead Variances**

(i) **Fixed Overhead Cost Variance**

$$FOCV = \begin{pmatrix} \text{St. hours for actual output} \times \text{St. overhead rate} \end{pmatrix} - \text{Actual overhead rate}$$

$$= (5{,}500 \times ₹\ 2) - 13{,}000 = ₹\ 2{,}000\ (A)$$

(ii) **Overhead Expenditure or Budget Variance (OBV)**

$$= \text{Budgeted overhead} - \text{Actual overhead}$$

$$= 12{,}500 - 13{,}000 \qquad = ₹\ 500\ (A)$$

(iii) **Overhead Volume Variance (OVV)**

$$= \begin{pmatrix} \text{St. hrs. for actual production} - \text{Budgeted hrs.} \end{pmatrix} \times \text{St. rate}$$

$$= (5{,}500 - 6{,}250) \times ₹\ 2 \qquad = ₹\ 1{,}500\ (A)$$

Check

$$FOCV = OBV + OVV$$

₹ 2,000 (A) = ₹ 500 (A) + ₹ 1,500 (A)

Sub-division of Overhead Volume Variance

Volume variance is further sub-divided into the following variances :

1. Efficiency Variance.
2. Capacity Variance.
3. Calender Variance.

Fixed Overhead Efficiency Variance. This is defined as *"that portion of volume variance which reflects the increased or reduced output arising from efficiency above or below the standard which is expected"*. This variance thus shows that the actual quantity produced is different from standard quantity because of higher or lower efficiency of workers engaged in production. Its formula is :

Efficiency Variance	*= Absorbed fixed overhead – Standard fixed overhead*
	= (St. hrs. for actual output – Actual hours) × St rate

Fixed Overhead Capacity Variance This is *"that portion of the volume variance which is due to working at higher or lower capacity usage than the standard"*. Thus this variance arises when plant capacity actually utilised is more or less than the capacity planned to be utilised due to factors like idle time, under or over customer demand, strikes, power failure, etc. Its formula is :

Capacity Variance	*= (Standard fixed overhead – Budgeted overhead)*
Or	*= (Actual hrs. worked – Budgeted hours) × St. rate*

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Example:

Calculate fixed overhead efficiency variance and capacity variance from information given in Illustration 3.10.

Solution

$$\textbf{Efficiency Variance} = \left(\begin{matrix}\text{St. hrs. for}\\ \text{actual output}\end{matrix} - \begin{matrix}\text{Actual}\\ \text{hours}\end{matrix}\right) \times \text{St. rate}$$

$$= (5{,}500 - 5{,}750) \times ₹\ 2 \quad = ₹\ 500\ (A)$$

$$\textbf{Capacity Variance} = \left(\begin{matrix}\text{Actual}\\ \text{hours}\end{matrix} - \begin{matrix}\text{Budgeted}\\ \text{hours}\end{matrix}\right) \times \text{St. rate}$$

$$= (5{,}750 - 6{,}250) \times ₹\ 2 \quad = ₹\ 1{,}000\ (A)$$

Check

Volume Variance = *Efficiency Variance + Capacity Variance*

₹ 1,500 (A) = ₹ 500 (A) + ₹ 1,000 (A).

Calendar Variance. It may be defined as *"that portion of the volume variance which is due to the difference between the number of working days in the budget period and the number of actual working days in the period to which the budget is applied"*. Calendar variance is actually volume variance arising due to a particular cause. i.e., actual number of working days being different from those budgeted due to extra holiday being declared on the death of a national leader or any other reason. Calendar variance arises only in exceptional cirmustances because normal holidays are taken into account while laying down the standard.

When calendar variance is calculated, the calculation of capacity variance has to be modified so as to induct this additional variance into the analysis. Calendar variance is calculated by the following formula :

$$\text{Calendar Variance} = \left(\begin{matrix}\text{Actual No. of}\\ \text{working days}\end{matrix} - \begin{matrix}\text{St. No. of}\\ \text{working days}\end{matrix}\right) \times \text{St. rate per day}$$

$$\text{Or} = \left(\begin{matrix}\text{Revised budgeted}\\ \text{hours}\end{matrix} - \begin{matrix}\text{Budgeted}\\ \text{hours}\end{matrix}\right) \times \text{St. rate per hour}$$

Generally, this variance is adverse because of extra holidays, but if there are extra working days (because of less holidays), then this variance will be favourable.

Illustration 3.11

The following information is given :

St. fixed overhead rate (per hour)	₹ 5
Budgeted hours	12,500
St. No. of working days	25
Actual hours	11,500
Actual No. of working days	22

Calculate Calendar Variance.

Solution

St. No. of hrs. per day = 12,500 ÷ 25 days = 500

Revised budgeted hours = St. hours per day × Actual No. of days

= 500 × 22 = **11,000**

Calendar Variance = (11,000 – 12,500) × ₹ 5
= **₹ 7,500 (A)**

Alternative Method

St. overhead rate per day = *St. hrs. per day* × *St. rate per hr*
= 500 hrs × ₹ 5 = ₹ 2,500

Calendar Variance = $\left(\begin{matrix}\textit{Actual No. of}\\ \textit{working days}\end{matrix} - \begin{matrix}\textit{St. No. of}\\ \textit{working days}\end{matrix}\right) \times \begin{matrix}\textit{St. rate}\\ \textit{per day}\end{matrix}$

= (22 – 25) × 2,500 = **₹ 7,500 (A)**

Revised Capacity Variance

When calendar variance is to be calculated, the method of calculating capacity variance has to be modified. The new formula in that case is a follows.

Revised Capacity Variance = $\left(\begin{matrix}\textit{Actual No. of}\\ \textit{working days}\end{matrix} - \begin{matrix}\textit{St. No. of}\\ \textit{working days}\end{matrix}\right) \times$ *St. rate per day*

In the Illustration given above, capacity variance will be calculated as follows :

Revised Capacity Variance = (11,500 – 11,000) × ₹ 5. = **₹ 2,500 (F)**

Illustration 3.12

XYZ Ltd. has furnished you the following information for the month of August :

	Budget	*Actual*
Output (units)	30,000	32,500
Hours	30,000	33,000
Fixed overhead	₹ 45,000	50,000
Variable overhead	₹ 60,000	68,000
Working days	25	26

Calculate overhead variances.

Solution

Basic calculations :

Standard hours per unit = $\frac{\textit{Budgeted hours}}{\textit{Budgeted units}} = \frac{30,000}{30,000} = 1\ \textit{hour}$

St. hrs. for actual output = 32,500 units × 1 hr = 32,500

Standard overhead rate per hour = $\frac{\text{Budgeted overhead}}{\text{Budgeted hours}}$

For fixed overheads = $\frac{45,000}{30,000}$ = ₹ 1.50 per hour

For variable overhead = $\frac{60,000}{30,000}$ = ₹ 2.00 per hour

St. F.O. rate per day = ₹ 45,000 ÷ 25 days = ₹ 1,800

Recovered overhead = St. hrs. for actual output × St. rate

For fixed overhead = 32,500 hrs. × ₹ 1.50 = ₹ 48,750

For variable overhead = 32,500 hrs. × ₹ 2 = ₹ 65,000

Standard overhead = Actual hours × St. rate

For fixed overhead = 33,000 × 1.50 = ₹ 49,500

For variable overhead = 33,000 × 2 = ₹ 66,000

Revised budgeted hours = $\frac{\text{Budgeted hours}}{\text{Budgeted days}} \times \text{Actual days}$

= $\frac{30,000}{25} \times 26 = 31,200$ hours.

Revised budgeted overhead (For fixed overhead)

= 31,200 × 1.50 = ₹ 46,800

Calculation of variances

Fixed Overhead Variances :

(*i*) F.O. Cost Variance = Recovered Overhead – Actual Overhead
= 48,750 – 50,000 = **₹1,250 (A)**

(*ii*) F.O. Expenditure Variance = Budgeted Overhead – Actual Overhead
= 45,000 – 50,000 = **₹ 5,000 (A)**

(*iii*) F.O. Volume Variance = Recovered Overhead – Budgeted Overhead
= 48,750 – 45,000 = **₹ 3,750 (F)**

(*iv*) F.O. Efficiency Variance = Recovered Overhead – Standard Overhead
= 48,750 – 49,500 = **₹ 750 (A)**

(*v*) F.O. Capacity Variance = Standard Overhead – Revised Budgeted Overhead
= 49,500 – 46,800 = **₹ 2,700 (F)**

(*vi*) Calendar Variance = $\left(\begin{matrix}\text{Actual}\\ \text{days}\end{matrix} - \begin{matrix}\text{Budgeted}\\ \text{days}\end{matrix}\right) \times \text{St. rate per day.}$
= (26 – 25) × 1,800 = **₹ 1,800 (F)**

Variable Overhead Variances

(*i*) V.O. Cost Variance = Recovered Overhead – Actual Overhead
= 65,000 – 68,000 = **₹ 3,000 (A)**

(*ii*) V.O. Expenditure Variance = St. Overhead – Actual Overhead
= 66,000 – 68,000 = **₹ 2,000 (A)**

(*iii*) V.O. Efficiency Variance = Recovered Overhead – St. overhead
= 65,000 – 66,000 = **₹ 1,000 (A)**

Check

(*i*) F.O. Cost Variance = Expenditure Variance + Efficiency Variance + Capacity Variance + Calendar Variance

1,250 (A) = 5,000 (A) + 750 (A) + 2,700 (F) + 1,800 (F)

(*ii*) F.O. Volume Variance = Efficiency Variance + Capacity Variance + Calendar Variance

3,750 (F) = 750 (A) + 2,700 (F) + 1,800 (F)

(*iii*) V.O. Cost Variance = Expenditure Variance + Efficiency Variance

3,000 (A) = 2,000 (A) + 1,000 (A).

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SALES VARIANCES

Some companies calculate only cost variances relating to material, labour and overheads. These variances are, of course, invaluable, but to obtain full advantage of standard costing system, many companies also calculate sales variances. While cost variances are concerned with cost and their effect on budgeted profit due to favourable or adverse variances, the sales variances affect the budgeted profit due to changes in sales revenue *i.e.*, changes caused by either a variation in selling prices or sales quantities.

There are two distinct methods of calculating sales variances :

(*a*) Turnover (or value) method

(*b*) Margin (or profit) method

The following chart shows the various main and sub-variances of sales.

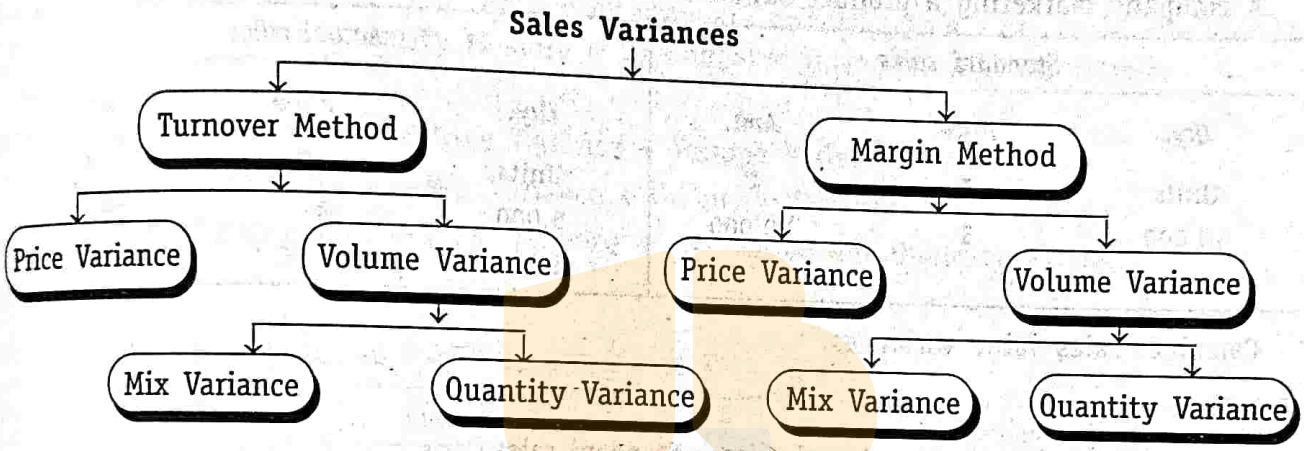

Fig. 3.3 Sales Variances

TURNOVER METHOD OR SALES VALUE METHOD

Under this method, the following variances are calculated:

1. **Sales Value Variance.** This is the difference between the budgeted value and the actual value of sales effected during a period. This variance is calculated as follows :

Sales Value Variance = (Actual sales) – (Budgeted sales)

Sales value variance results due to one or more of the following reasons :

(*a*) Actual sales volume being more or less than the standard sales volume. This is expressed in sales volume variance.

(*b*) Actual sales price received being higher or lower than the standard sales price. This is expressed in sales price variance.

(*c*) A mix of products has been sold which is different from the standard mix. This is expressed in sales mix variance.

2. **Sales Volume Variance.** Volume refers to the number of physical units. Sales volume variance, therefore, represents that portion of the sales value variance which is due to the difference between the actual volume and standard volume of sales. The formula is :

Sales Volume Variance = (Actual quantity – Budgeted quantity) × Standard price
= Standard sales – Budgeted sales

Reasons. The usual reasons for this variance are : 1. Ineffective advertising and sales promotion. 2. Unexpected competition. 3. Lack of proper supervision and control of salesmen.

3. **Sales Price Variance.** Sales price variance is that portion of the sales value variance which is due to the difference between standard price specified and the actual price charged. The formula for its calculation is :

Sales Price Variance = (Actual price – Standard price) × Actual quantity.
= Actual Sales – Standard Sales

If actual price is less than the standard price, possible reason may be unforeseen competition. The price may also have to be reduced if a larger number of units have to be sold.

Illustration 3.13

A company marketing a product supplies the following information :

Standard sales			*Actual sales*		
Qty.	*Price*	*Amt.*	*Qty.*	*Price*	*Amt.*
Units	₹	₹	Units	₹	₹
10,000	3	30,000	5,000	3	15,000
			8,000	2.50	20,000

Calculate sales value variances.

Solution

Sales Value Variance = Actual sales – Standard sales
= [(5,000 × 3) + (8,000 × 2.50)] – (10,000 × 3)
= 35,000 – 30,000 = **₹5,000 (F)**

Sales Volume Variance = (AQ – BQ) × SP
= (13,000 – 10,000) × 3 = **₹ 9,000 (F)**

Sales Price Variance = (AP – SP) × AQ
= (3 – 3) × 5,000 = Nil
(2.50 – 3) × 8,000 = **₹ 4,000 (A)**
Total = **₹ 4,000 (A)**

Check

Sales Value Variance = Volume Variance + Price Variance
5,000 (F) = 9,000 (F) + 4,000 (A)

4. Sales Mix Variance. When a company is selling more than one type of product, a budget will be prepared to show the budgeted sales of each product. If actual sales of different products is not in the same proportion as budgeted, a sales mix variance will arise. Sales mix variance is *"that portion of the sales volume variance which is due to the difference between the standard and the actual inter-relationship of the quantities of each product or product group of which sales are composed".*

It is calculated by the following formula :

Sales Mix Variance = (Actual quantity – Revised standard quantity) × Standard price
or = Standard sales – Revised standard sales.

Revised standard quantity is calculated as under :

$$= \frac{\text{Total of actual quantiies of all products}}{\text{Total of standard quantities of all products}} \times \text{Standard quantity of one product}$$

5. **Sales Quantity Variance.** The variance is the difference between the budgeted sales and revised standard sales. Its formula is :

$$\text{Sales Quantity Variance} = \left(\text{Revised standard quantity} - \text{Budgeted quantity}\right) \times \text{Standard price}$$

$$= \text{Revised standard sales} - \text{Budgeted sales.}$$

Revised standard quantity means actual sales quantity in budgeted ratio of products. Where the budgeted quantity is more than the revised standard quantity, this variance is adverse and when the revised standard quantity is more than budgeted quantity, it is favourable.

Check

Sales Value Variance = Price Variance + Volume Variance.

Sales Volume Variance = Mix Variance + Quantity Variance.

∴ Sales Value Variance = Price Variance + Mix Variance + Quantity Variance.

Illustration 3.14

The following data relates to two products *X* and *Y*.

Product	Budget			Actual		
	Qty.	Price	Value	Qty.	Price	Value
		₹	₹		₹	₹
X	1,000	5	5,000	1,200	6	7,200
Y	1,500	10	15,000	1,400	9	12,600
Total	2,500		20,000	2,600		19,800

Calculated sales variances by Turnover Method.

Solution

(Assuming that the products X and Y are homogeneous, quantity technique has been used)

Calculation of Standard Sales

Product	Actual quantity (A)	Budgeted price (B)	Standard sales (A × B)
X	1,200	5	6,000
Y	1,400	10	14,000
Total	2,600		20,000

Calculation of Revised Standard Quantity

$$\text{Revised SQ} = \frac{\text{Total AQ}}{\text{Total SQ}} \times \text{SQ of each product}$$

$$X = \frac{2,600}{2,500} \times 1,000 = 1,040 \text{ units}$$

$$Y = \frac{2,600}{2,500} \times 1,500 = 1,560 \text{ units}$$

Calculation of Variances

1. Sales Value Variance = Actual sales – Budgeted sales
= 19,800 – 20,000 = ₹ **200 (A)**

2. Sales Price Variance = $(AP - SP) \times AQ$

$X = (6 - 5) \times 1,200$ = ₹ 1,200 (F)

$Y = (9 - 10) \times 1,400$ = ₹ 1,400 (A)

Total = ₹ **200 (A)**

3. Sales Volume Variance = $(AQ - BQ) \times SP$

$X = (1,200 - 1,000) \times 5$ = ₹ 1,000 (F)

$Y = (1,400 - 1,500) \times 10$ = ₹ 1,000 (A)

Total Nil

4. Sales Mix Variance = $(AQ - RSQ) \times SP$

$X = (1,200 - 1,040) \times 5$ = ₹ 800 (F)

$Y = (1,400 - 1,560) \times 10$ = ₹ 1,600 (A)

= ₹ **800 (A)**

5. Sales Quantity Variance = $(RSQ - BQ) \times SP$

$X = (1,040 - 1,000) \times 5$ = ₹ 200 (F)

$Y = (1,560 - 1,500) \times 10$ = ₹ 600 (F)

Total = ₹ **800 (F)**

Check

(*i*) Sales Value Variance = Price Variance + Volume Variance

200 (*A*) = 200 (*A*) + Nil

(*ii*) Volume Variance = Mix Variance + Quantity Variance

Nil = 800 (*A*) + 800 (*F*)

SALES MARGIN METHOD

The sales margin method measures the effect on profit of deviations of actual from planned sales. Management is primarily interested in knowing these sales margin variances. *Sales margin variance analysis assumes all costs are at standard.* Under this method, the following variances are calculated :

Total Sales Margin (Profit) Variance. This variance is the difference between actual profit and budgeted profit. Its formula is :

$$\text{Total sales Margin Variance} = \left(\text{Actual quantity} \times \text{Actual profit per unit}\right) - \left(\text{Budgeted quantity} \times \text{Standard profit per unit}\right)$$

$$= \text{Actual profit} - \text{Budgeted profit.}$$

Budgeted profit is calculated by multiplying budgeted quantity of sales with budgeted (or standard) profit per unit.

Total sales margin variance is divided into price variance and volume variance.

Sales Margin Price Variance. It is the difference between actual profit and standard profit. Thus :

$$\text{Price Variance} = \text{Actual profit} - \text{Standard profit.}$$

Standard profit is calculated by multiplying the actual quantity of sales with the budgeted (or standard) profit per unit. This variance is equal to the price variance calculated under sales value method. Thus it can also be calculated by the following formula :

$$\text{Price Variance} = \left(\text{Actual profit per unit} - \text{St. profit per unit}\right) \times \text{Actual quantity sold}$$

Sales Margin Volume Variance. This is the difference between standard profit and budgeted profit. Thus :

$$\text{Volume Variance} = \text{Standard profit} - \text{Budgeted Profit}$$

It may also be calculated by the following method :

$$\text{Volume Variance} = \left(\text{Actual quantity} - \text{Budgeted quantity}\right) \times \text{Standard profit per unit}$$

This Volume Variance is further sub-divided into mix variance and quantity variance.

Sales Margin Mix Variance – This variance arises only when a company is selling more than one type of product. Its formula is as follows :

$$\text{Sales Margin Mix Variance} = \left(\text{Actual quantity} - \text{Revised standard quantity}\right) \times \text{Standard profit per unit}$$

$$= \text{Standard profit} - \text{Revised standard profit}$$

Sales Margin Quantity Variance. It is the difference between revised standard profit and budgeted profit. Its formula is :

$$\text{Sales Margin Quantity Variance} = \left(\text{Revised standard quantity} - \text{Budgeted quantity}\right) \times \text{Standard profit per unit}$$

$$= \text{Revised standard profit} - \text{Budgeted profit}$$

Check

(*i*) Total Sales Margin Variance = Price Variance + Volume Variance

(*ii*) Sales Margin Volume Variance = Mix Variance + Quantity Variance

Therefore :

(*iii*) Total Sales Margin Variance= Price Variance + Mix Variance + Quantity Variance

Illustration 3.15

The following data is supplied to you for the month of January 2017

	Budgeted sales			Actual sales		
	Qty.	Price	Value	Qty.	Price	Value
		₹	₹		₹	₹
Ess	1,200	5	6,000	1,000	5.00	5,000
				300	4.75	1,425
Kay	2,000	2	4,000	1,500	2.00	3,000
				350	1.90	665
Total			10,000			10,090

Budgeted costs are: Ess – ₹ 4.00 per unit, Kay – ₹ 1.50 per unit.
Calculate sales margin variances.

Solution

(Assuming that the products Ess and Kay are homogeneous, quantity technique is used here)

Calculation of actual, standard and budgeted profits

Product	Actual profit per unit	Actual quantity	Actual profit	St. profit per unit	Standard profit	Standard quantity	Budgeted profit
1	2	3	4 (2 × 3) ₹	5 ₹	6 (3 × 5) ₹	7	8 (5 × 7) ₹
Ess	1.00	1,000	1,000	1.00	1,000	1,200	1,200
	0.75	300	225	1.00	300		
Kay	0.50	1,500	750	0.50	750	2,000	1,000
	0.40	350	140	0.50	175		
Total		3,150	2,115		2,225	3,200	2,200

Calculation of revised standard profit

Product	Revised St. Qty. (units)	St. profit per unit ₹	Revised St. profit ₹
Ess	$\frac{1,200}{3,200} \times 3,150 = 1,181$	1.00	1,181.00
Kay	$\frac{2,000}{3,200} \times 3,150 = 1,969$	0.50	984.50
Total			2,165.50

Calculation of Variances

1. **Total Sales Margin Variance** = Actual profit – Budgeted Profit
   = 2,115 – 2,200 = ₹ **85 (A)**
2. **Sales Margin Price Variance** = Actual Profit – Standard Profit
   = 2,115 – 2,225 = ₹ **110 (A)**

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3. **Sales Margin Volume Variance** = St. Profit – Budgeted Profit
= 2,225 – 2,200 = ₹ 25 (F)

4. **Sales Margin Mix Variance** = St. Profit – Revised St. Profit
= 2,225 – 2,165.50 = ₹ 59.50 (F)

5. **Sales Margin Quantity Variance** = Revised St. Profit – Budgeted Profit
= 2,165.50 – 2,200 = ₹ 34.50 (A)

Check

(i) Total Sales Margin Variance ₹ 85 (A) = Price Variance + Volume Variance
= ₹ 110 (A) + ₹ 25 (F)

(ii) Volume Variance ₹ 25(F) = Mix Variance + Quantity Variance
= 59.50 (F) + 34.50 (A)

Quantity Technique and Value Technique of Computing Sales Mix Variance

Sales mix variance may be calculated by using either quantity technique or value technique.

1. **Quantity Technique.** This technique is used when various products being sold are homogeneous. For example, Maruti Car Company is selling different types of cars. In this technique, computation of sales mix variance is similar to material mix variance. This technique of calculating sales mix variance and sales quantity variance was used in Illustration 3.14.

2. **Value Technique.** This technique is used when products being sold are not homogeneous. For example, a company is selling TVs, computers, airconditioners etc. In this technique, revised standard sales value (instead of sales quantity) is calculated.

Under value technique, sales value variance, sales price variance and sales volume variance will be the same as calculated under Quantity Technique. However, sales mix variance and sales quantity variance may be different.

Illustration 3.16

Compute sales variances by turnover method using value technique from the date given in Illustration 3.14

Solution

As stated above, sales value, price and volume variance will not be affected. Only mix and quantity variances well be different. These are computed as follows:

Basic calculations

(a) Standard sales = Actual quantities sold valued at standard prices.

(b) Revised standard sales = Standard sales value re-arranged in the budgeted ratio.

Products	*Standard Sales (SS)*			*Revised standard sales (RSS)*	
	Actual Qty.	*Standard Price* ₹	*Value* ₹	*Ratio*	₹
X	1,200	5	6,000	25%	5.000 *
Y	1,400	10	14,000	75%	15,000 *
Total			20,000		20,000

*Revised standard sales = $\frac{\text{Budgeted sales of individual products}}{\text{Total budgeted sales}}$ × Total standard sales

$$X = \frac{5,000}{20,000} \times 20,000 = ₹\ 5,000$$

$$Y = \frac{15,000}{20,000} \times 20,000 = ₹\ 15,000$$

Calculation of Variances

Sales Mix Variance	= *SS* – *RSS*	
X	= 6,000 – 5,000	= 1,000 (F)
Y	= 14,000 – 15,000	= 1,000 (A)
	Total =	NIL

Sales Quantity Variance	= *RSS* – *BS*	
X	= 5,000 – 5,000	= NIL
Y	= 15,000 – 15,000	= NIL
	Total =	NIL

Check

Sales Volume Variance = Mix Variance + Quantity variance

Nil = Nil + Nil

Note : It should be noted that under Turnover Method, while using value technique, sales mix variance will always be zero because it is based on a re-arrangement of standard sales in terms of budgeted ratio, i.e., total standard sales and total revised standard sales represent the same figure.

DISPOSITION OF VARIANCES

When standard costs are not entered in the books of account and are used only as a statistical information, no adjustments are required at the end of the period for the variances. However, when standard costs are incorporated into the accounting system through journals and ledgers, there arises a question of adjustment and disposition of variances at the end of the accounting period.

There is no uniformity of opinion as to the proper disposition of variances. Therefore, no hard and fast rules can be laid down in this regard. The following methods of disposition of variances are based on practice followed in certain firms.

1. Transfer to Profit and Loss Account

Under this method, all variances are transferred to Profit and Loss Account at the end of the accounting period. Thus, the stocks of work-in-progress and finished stock and cost of sales are maintained at standard costs. This method is based on the assumption that standard costs represent correct or real costs and all forms of variances represent conditions of inefficiency, waste and below standard performance.

The method has the advantage of prompt and uniform valuation of inventories. Moreover, presentation of variances as a separate group of items in the Profit and Loss Statement reflects on profit or loss and attracts the attention of the management.

2. Allocation of Variances to Inventories and Costs of Sales

Under this method, variances are distributed over stocks of work-in-progress, finished stock and cost of sales. This will result in showing inventories and costs of sales at actual costs. This method is based on the premise that standard costs are only tools of control and do not represent the true or real costs. According to this method, thus actual costs should be reflected in the financial statements.

3. Combination Method

Both the methods explained above are quite easy to apply, but variances are not disposed of in accordance with the best accounting practice. The best and most logical way is to combine the first two methods by analysing the variances according to the causes and disposing them off according to the underlying reasons for their existence.

All those variances which result from controllable factors and represent responsibilities of executives, should be transferred to Profit and Loss Account. On the other hand, those variances which result form incorrect standards or uncontrollable causes should be allocated to inventories and cost of goods sold on some equitable basis. For example, variance due to idle time (controllable) should be transferred to Profit and Loss Account and variance due to change in material prices in the market (uncontrollable) should be prorated to inventory and cost of goods sold.

CONTROL RATIOS

In addition to variances, certain control ratios are commonly used by management for use in controlling operations. These ratios are generally expressed in terms of percentage. If the ratio is 100% or more, it indicates a favourable position and versa, if the ratio is less than 100%, it indicates unfavourable position. Three important control ratios are given below :

1. **Efficiency Ratio** It is defined as *"the standard hours equivalent to the work produced expressed as a percentage of actual hours spent in production"*. Thus, this ratio shows whether actual time taken in production is more or less than the time allowed by the standard. Its method of calculation is :

$$\text{Efficiency ratio} = \frac{\text{Standard hours for actual output}}{\text{Actual hours worked}} \times 100$$

2. **Activity Ratio** It is defined as *"the standard hours equivalent to the work produced, expressed as percentage of budgeted standard hours"*. This ratio shows the extent to which the production facilities have been utilised as compared with that contemplated in budgets. Its formula is :

$$\text{Activity ratio} = \frac{\text{Standard hours for actual output}}{\text{Budgetary hours}} \times 100$$

3. **Capacity Ratio** It shows the relationship between actual hours worked and the budgeted hours. Its formula is :

$$\text{Capacity ratio} = \frac{\text{Actual hours worked}}{\text{Budgeted hours}} \times 100$$

Calender Ratio. Sometimes calender ratio is also calculated. This ratio indicates the extent of actual working days availed during the budget period. It is calculated by using the following formula :

$$\text{Calender Ratio} = \frac{\text{Actual working days in the budget period}}{\text{Budgeted working days in the budget period}} \times 100$$

Illustration 3.16

Two articles *A* and *B* are manufactured in a department of *XYZ* Co. Ltd. Their specifications show that 2 units of *A* and 8 units of *B* can be produced in one hour. The budgeted production for a month is 400 units of *A* and 1,600 units of *B*. Actual production during the month is 600 units of *A* and 2,000 units of *B*. Actual hours spent in production were 480. There were 25 working days specified in the budget. However, actually worked days were 26 during the month.

Your are required to calculate the following ratios :

(*a*) Activity Ratio (*b*) Capacity Ratio (*c*) Efficiency Ratio (*d*) Calender Ratio *(Adapted)*

Solution

Basic calculations :

Budgeted hours for the month :

A	= 400 ÷ 2	= 200 hours
B	= 1,600 ÷ 8	= 200 hours
	Total	400 hours

Standard hours for actual production.

A	600 ÷ 2	= 300 hours
B	2,000 ÷ 8	= 250 hours
	Total	550 hours

(*a*) **Activity Ratio** $= \dfrac{\textit{St. hours for actual production} \times 100}{\textit{Budgeted hours}}$

$= \dfrac{550}{400} \times 100 = \mathbf{137.50\%}$

(*b*) **Capacity Ratio** $= \dfrac{\textit{Actual hours worked}}{\textit{Budgeted hours}} \times 100$

$= \dfrac{480}{400} \times 100 = \mathbf{120\%}$

(*c*) **Efficiency Ratio** $= \dfrac{\textit{St. hours for actual production} \times 100}{\textit{Actual hours}}$

$= \dfrac{550}{480} \times 100 = \mathbf{114.58\%}$

(*d*) **Calender Ratio** $= \dfrac{\textit{Actual worked days} \times 100}{\textit{Budgeted working days}}$

$= \dfrac{26}{25} \times 100 = \mathbf{104\%}$

Check

Activity Ratio = Capacity Ratio × Efficiency Ratio

137.50 % = 120 % × 114.58 %

SUMMARY OF FORMULAE

Material Variances

(*i*) *Material Cost Variance* = St. cost of actual output – Actual cost

= (St. qty. for actual output × St. price) – (Actual qty. × Actual price)

(ii) *Material Price Variance* = (St. price – Actual price) × Actual qty.
(iii) *Material Usage Variance* = (SQ for actual output – Actual qty.) × St. price
(iv) *Material Mix Variance* = (Revised SQ – Actual qty.) × St. price
(v) *Material Yield Variance* = (Actual yield – St. yield) × St. output price
(vi) *Material Revised Usage Variance* = (*SQ.* for actual output – Revised *SQ.*) × St. price

Labour Variances

(i) *Labour Cost Variance* = St. cost of actual output – Actual cost
= (St. hrs. for actual output × St. rate) – (Actual hours × Actual rate)
(ii) *Labour Rate Variance* = (St. rate – Actual rate) × Actual hours
(iii) *Labour Efficiency Variance* = (St. hrs. for actual output – Actual hrs.) × St. rate
(iv) *Idle Time Variance* = Idle hours × Standard rate
(v) *Labour Mix Variance* = (Revised st. hours – Actual hours) × St. rate.
(vi) *Labour Yield Variance*
= (Actual yield – St. yield for actual hours) × St. cost per unit of output
(vii) *Labour Revised Efficiency Variance*
= (St. hours for actual output – Revised standard hours) × Standard rate

Overhead Variances

Variable Overhead (*VO*) Variances:

(i) *Variable Overhead Cost Variance* = Absorbed overhead – Actual overhead
(ii) *VO Expenditure Variance* = Standard overhead – Actual overhead
(iii) *VO Efficiency Variance* = Absorbed overhead – Standard overhead

Fixed Overhead (*FO*) Variances:

(i) *FO Cost Variance* = Absorbed overhead – Actual overhead
(ii) *FO Expenditure Variance* = Budgeted overhead – Actual overhead
(iii) *FO Volume Variance* = Absorbed overhead – Budgeted overhead
(iv) *FO Efficiency Variance* = Absorbed overhead – Standard overhead
(v) *FO Capacity Variance* = Standard overhead – Budgeted overhead
(vi) *FO Revised Capacity Variance* = St. overhead – Revised budgeted overhead

(vii) *Calendra Variance* $= \left(\begin{matrix}\text{Actual No. of}\\ \text{working days}\end{matrix} - \begin{matrix}\text{St. No. of}\\ \text{working days}\end{matrix}\right) \times \begin{matrix}\text{St. rate}\\ \text{per day}\end{matrix}$

Or = (Revised budegeted hours – Budegeted hours) × St. rate per hour.

Sales Variances

Sales Value Method

(i) *Sales Value Variance* = Actual sales – Budgeted sales
(ii) *Sales Volume Variance* = Standard sales – Budgeted sales
$= (AQ - BQ) \times SP$
(iii) *Sales Price Variance* = Actual sales – Standard sales
$= (AP - SP) \times AQ$

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(iv) Sales Mix Variance = St. sales – Revised st. sales
= (*AQ* – Revised *SQ*) × *SP*

(v) Sales Quantity Variance = Revised St. Sales – Budgeted sales
= (Revised *SQ* – Budgeted qty.) × *SP*

Sales Margin Method

(i) Total Sales Margin Variance = Actual profit – Budgeted profit

(ii) Sales Margin Price Variance = Actual profit – Standard profit
= (Actual profit per unit–St. profit per unit) × *AQ*

(iii) Sales Margin Volume Variance = Standard profit – Budgeted profit
= (*AQ* – *BQ*) × St. profit per unit

(iv) Sales Margin Quantity Variance = Revised St. profit – Budgeted profit
= (Revised *SQ* – *BQ*) × St. profit per unit

(v) Sales Margin Mix Variance = St. profit – Revised St. profit
= (*AQ* – Revised *SQ*) × St. profit per unit.

Control Ratios

(i) Efficiency Ratio $= \frac{\text{St. hours for actual output}}{\text{Actual hours worked}} \times 100$

(ii) Activity Ratio $= \frac{\text{Standard hrs. for actual output}}{\text{Budgeted hours}} \times 100$

(iii) Capacity Ratio $= \frac{\text{Actual hours worked}}{\text{Budgeted hours}} \times 100$

(iv) Calender Ratio $= \frac{\text{Actual working days}}{\text{Budgeted working days}} \times 100$

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PROBLEMS AND SOLUTIONS

Problem 3.1 ***(Material Variances)***

From the following particulars, compute:

(*a*) Material cost variance, (*b*) Material price variance, and (*c*) Material usage variance

Quantity of materials purchased	3,000 units
Value of materials purchased	₹ 9,000
Standard quantity of materials required per ton of output	30 units
Standard price of material	₹ 2.50 per unit
Opening stock of materials	Nil
Closing stock of materials	500 units
Output during the period	80 tons

(B.Com., Hons. Delhi)

Solution

Basic calculations:

Actual quantity of material purchased = 3,000 units
Value of materials purchased = ₹ 9,000

$$\text{Actual price per unit} = \frac{₹\ 9,000}{3,000 \text{ units}} = ₹\ 3 \text{ per unit}$$

Standard price = 2.50 per unit
Standard quantity = 80 tons × 30 units = 2,400 units
Actual quantity = Opening stock + Purchase − Closing stock
= Nil + 3,000 − 500 = 2,500 units

Calculation of variances

(*a*) **Material Cost Variance** = $SC - AC$
= $(SQ \times SP) - (AQ \times AP)$
= $(2,400 \times 2.50) - (2,500 \times 3.00)$
MCV = **₹ 1,500 (A)**

(*b*) **Material Price Variance** = $(SP - AP) \times AQ$
= $(2.50 - 3.00) \times 2,500$
MPV = **₹ 1,250 (A)**

(*c*) **Material Usage Variance** = $(SQ - AQ) \times SP$
= $(2,400 - 2,500) \times 2.50$
MUV = **₹ 250 (A)**

Check

$MCV = MPV + MUV$
₹ 1,500 (A) = ₹ 1,250 (A) + ₹ 250 (A)
₹ 1,500 (A) = ₹ 1,500 (A)

Problem 3.2 (*Material Variances*)

A manufacturing concern which has adopted standard costing furnishes the following information :

Standard :

Material for 70 kg finished products	100 kg
Price of material	₹ 1 per kg

Actual :

Output	2,10,000 kg
Material used	2,80,000 kg
Cost of materials.	₹ 2,52,000

Calculate :

(*a*) Material usage variance, (*b*) Material price variance, (*c*) Material cost variance.

(B.Com. Kerala)

Solution

$$\text{Standard Quantity } (SQ) \text{ for actual output} = 2,10,000 \text{ kg} \times \frac{100 \text{ kg}}{70 \text{ kg}} = 3,00,000 \text{ kg}$$

Actual Quantity (AQ) = 2,80,000 kg
Standard Price (SP) = ₹ 1 per kg

Actual Price (*AP*) = (₹ 2,52,000 ÷ 2,80,000 kg) = Re 0.90 per kg.

(*a*) **Material Usage Variance** = (*SQ* – *AQ*) × *SP*
= (3,00,000 – 2,80,000 kg.) × 1 = **₹ 20,000 (F)**

(*b*) **Material Price Variance** = (*SP* – *AP*) × *AQ*
= (1 – 0.90) × 2,80,000 = **₹ 28,000 (F)**

(*c*) **Material Cost Variance** = (*SQ* × *SP*) – (*AQ* × *AP*)
= (3,00,000 × 1) – (2,80,000 × 0.90) = **₹ 48,000 (F)**

Check

MCV ₹ 48,000 (F)

MPV ₹ 28,000 (F) | MUV ₹ 20,000 (F)

Problem 3.3 *(Material Variances)*

For making 10 kg. of gemco, the standard material requirement is :–

Material	*Quantity (kg.)*	*Rate per kg. (₹)*
A	8	6.00
B	4	4.00

During April, 1,000 kg. of Gemco were produced. The actual consumption of materials is as under:

Material	*Quantity (kg.)*	*Rate per kg. (₹)*
A	750	7.00
B	500	5.00

Calculate (*a*) Material Cost Variance; (*b*) Material Price Variance; (*c*) Material usage Variance. *(C.A. Inter)*

Solution

Basic calculations

	Standard for 1000 kg.			*Actual for 1000 kg.*		
	Qty.	*Rate*	*Amount*	*Qty*	*Rate*	*Amount*
	Kg.	₹	₹	Kg.	₹	₹
A	800	6	4,800	750	7	5,250
B	400	4	1,600	500	5	2,500
Total	1,200		6,400	1,250		7,750

Calculation of Variances

(*a*) **Material Cost Variance** = *SC for actual output – AC*
MCV = 6,400 – 7,750 = **₹ 1,350 (A)**

(*b*) **Material Price Variance** = (*SP* – *AP*) × *AQ*
A = (6 – 7) × 750 = ₹ 750 (A)
B = (4 – 5) × 500 = ₹ 500 (A)
MPV = **₹ 1,250 (A)**

(*c*) **Material Usage Variance** = (*SQ* – *AQ*) × *SP*
A = (800 – 750) × 6 = ₹ 300 (F)
B = (400 – 500) × 4 = ₹ 400 (A)
MUV = **₹ 100 (A)**

Check

MCV ₹ 1,350 (A)

↓ MPV ₹ 1,250 (A)

↓ MUV ₹ 100 (A)

Problem 3.4 (*Material Variances*)

From the following information compute :
(*a*) Mix, (*b*) Price, and (*c*) Usage variances:

	Standard			*Actual*		
	Quantity (kg.)	*Unit price*	*Total*	*Quantity (kg.)*	*Unit price*	*Total*
		₹	₹		₹	₹
Material *A*	4	1.00	4.00	2	3.50	7.00
Material *B*	2	2.00	4.00	1	2.00	2.00
Material *C*	2	4.00	8.00	3	3.00	9.00
Total	8	2.00	16.00	6	3.00	18.00

(*B.Com. Hons., Delhi*)

Solution

Material Price Variance	= (*SP* – *AP*) × *AQ*		
Material *A*	= (1 – 3.50) × 2	= ₹	5 (A)
Material *B*	= (2 – 2) × 1	=	Nil
Material *C*	= (4 – 3) × 3	= ₹	3 (F)
	MPV	= ₹	2 (A)
Material Usage Variance	= (*SQ* – *AQ*) × *SP*		
Material *A*	= (4 – 2) × 1	= ₹	2 (F)
Material *B*	= (2 – 1) × 2	= ₹	2 (F)
Material *C*	= (2 – 3) × 4	= ₹	4 (A)
	MUV	=	Nil
Material Mix Variance	= (*Revised SQ* – *AQ*) × *SP*		
Material *A*	= (3 * – 2) × 1	= ₹	1 (F)
Material *B*	= (1.5 * – 1) × 2	= ₹	1 (F)
Material *C*	= (1.5 * – 3) × 4	= ₹	6 (A)
	MMV	= ₹	4 (A)

* Revised standard quantity is calculated as follows:

$$= \frac{\text{Standard quantity of material item}}{\text{Total standard quantity}} \times \text{Total actual quantity}$$

Material $A = \frac{4}{8} \times 6 = 3$ kg. Material $B = \frac{2}{8} \times 6 = 1.5$ kg.

Material $C = \frac{2}{8} \times 6 = 1.5$ kg.

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Problem 3.5 (*Material Variances*)

The standard cost of a chemical mixture is as follows:

40% material *A* at ₹ 20 per kg

60% material *B* at ₹ 30 per kg

A standard loss of 10% of input is expected in production. The cost records for a period showed the following usage:

90 kg material *A* at a cost of ₹ 18 per kg

110 kg material *B* at a cost of ₹ 34 per kg

The quantity produced was 182 kg of good product.

Calculate all material variances. *(B.Com. Hons., Delhi)*

Solution

Basic calculations:

Material	*Standard for 180 kg. output*			*Actual for 182 kg. output*		
	Qty.	*Rate*	*Amt.*	*Qty.*	*Rate*	*Amt.*
	kg.	₹	₹	kg.	₹	₹
A	80	20	1,600	90	18	1,620
B	120	30	3,600	110	34	3,740
Total	200		5,200	200		5,360
Less: Loss	20	—	—	18		—
	180		5,200	182		5,360

St. cost of actual output $= ₹\ 5{,}200 \times \frac{182}{180} = ₹\ 5{,}257.78$

Calculation of Variances

1. **Material Cost Variance** = (*SC of actual output* − *AC*)
   = (5,257.78 − 5,360) = **₹102.22 (A)**
2. **Material Price Variance** = (*SP* − *AP*) × *AQ*
   Material *A* = (20 − 18) × 90 = ₹ 180 (F)
   Material *B* = (30 − 34) × 110 = ₹ 440 (A)
   MPV = **₹ 260 (A)**
3. **Material Usage Variance** = (*SQ for actual output* − *AQ*) × *SP*
   Material *A* $= \left(120 \times \frac{182}{180} - 90\right) \times 20$ = ₹ 182.22 (A)
   Material *B* $= \left(120 \times \frac{182}{180} - 110\right) \times 30$ = ₹ 340.00 (F)
   MUV = **₹157.78 (F)**
4. **Material Mix Variance** = (*Revised SQ* − *AQ*) × *SP*
   Material *A* = (80 − 90) × 20 = ₹ 200 (A)
   Material *B* = (120 − 110) × 30 = ₹ 300 (F)
   MMV = **₹ 100 (F)**

5. **Material Yield Variance** = $(AY - SY) \times$ *St. material cost per unit of output*

$$MYV = (182 - 180) \times \frac{5,200}{180} = ₹57.78 \text{ (F)}$$

Check

MCV ₹ 102.22 (A)

MPV ₹ 260 (A)

MUV ₹ 157.78 (F)

MMV ₹ 100 (F)

MYV ₹ 57.78 (F)

Problem 3.6 (*Material Variances*)

The standard material cost to produce one tonne of chemical *X* is :

300 kg. of material *A* @ ₹ 10 per kg.
400 kg. of material *B* @ ₹ 5 per kg.
500 kg. of material *C* @ ₹ 6 per kg.

During a period, 100 tonnes of chemical *X* were produced from the usage of :

35 tonnes of material *A* at a cost of ₹ 9,000 per tonne
42 tonnes of material *B* at a cost of ₹ 6,000 per tonne
53 tonnes of material *C* at a cost of ₹ 7,000 per tonne

Calculate material variances. *(B.Com. Hons., Delhi)*

Solution

Basic Calculations : Conversion Rate is 1 tonne= 1,000 kg.

Material	*Standard for 100 tonnes*			*Actual for 100 tonnes*		
	Qty. Kg.	*Rate ₹*	*Amt. ₹*	*Qty. Kg.*	*Rate ₹*	*Amt. ₹*
A	30,000	10	3,00,000	35,000	9	3,15,000
B	40,000	5	2,00,000	42,000	6	2,52,000
C	50,000	6	3,00,000	53,000	7	3,71,000
Total	1,20,000		8,00,000	1,30,000		9,38,000
Less : Loss	20,000	–	–	30,000	–	–
Output	1,00,000	–	8,00,000	1,00,000	–	9,38,000

Calculation of Variances

1. **Material Cost Variance** = *SC* of actual output – *AC*

$$MCV = 8,00,000 - 9,38,000 = ₹\ 1,38,000 \text{ (A)}$$

2. **Material Price Variance** = $(SP - AP) \times AQ$

$$A = (₹\ 10 - ₹\ 9) \times 35,000 = ₹\ 35,000 \text{ (F)}$$
$$B = (₹\ 5 - ₹\ 6) \times 42,000 = ₹\ 42,000 \text{ (A)}$$
$$C = (₹\ 6 - ₹\ 7) \times 53,000 = ₹\ 53,000 \text{ (A)}$$
$$MPV = ₹\ 60,000 \text{ (A)}$$

3. Material Usage (or Quantity) Variance = $(SQ - AQ) \times SP$

A = (30,000 – 35,000) × ₹ 10	= ₹	50,000 (A)
B = (40,000 – 42,000) × ₹ 5	= ₹	10,000 (A)
C = (50,000 – 53,000) × ₹ 6	= ₹	18,000 (A)
MUV	= ₹	**78,000 (A)**

4. Material Mix Variance = (Revised SQ^* – AQ) × SP

A = (32,500 – 35,000) × 10	= ₹	25,000 (A)
$B = \left(\frac{1,30,000}{3} - 42,000\right) \times 5$	= ₹	6,667 (F)
$C = \left(\frac{1,62,500}{3} - 53,000\right) \times 6$	= ₹	7,000 (F)
MMV	= ₹	**11,333 (A)**

* Revised Standard Quantity is calculated as follows :

$$= \frac{\text{Total AQ}}{\text{Total SQ}} \times \text{SQ}$$

$$A = \frac{1,30,000}{1,20,000} \times 30,000 = 32,500 \text{ kg.}$$

$$B = \frac{1,30,000}{1,20,000} \times 40,000 = \frac{1,30,000}{3} \text{ kg.} \qquad C = \frac{1,30,000}{1,20,000} \times 50,000 = \frac{1,62,500}{3} \text{ kg.}$$

5. Material Yield Variance (*MYV*)

= (Actual yield – St. yield) × *St. cost per unit of output

$$= \left(100 - \frac{1,300^*}{12}\right) \times 8,000 = \textbf{₹ 66,667 (A).}$$

***Working Notes:**

1. Std. cost per unit of output $= \frac{\text{Total standard cost}}{\text{Total standard output}} = \frac{₹\ 8,00,000}{100 \text{ Tonnes}}$

$= ₹\ 8,000$ per tonne

2. Std. yield $= \frac{\text{Actual output}}{\text{Total SQ}} \times \text{Total AQ} = \frac{100 \text{ Tonnes}}{1,20,000} \times 1,30,000 = \frac{1,300}{12}$ tonnes.

Check

MCV ₹ 1,38,000 (A)

MPV ₹ 60,000 (A) | MUV ₹ 78,000 (A)

MMV ₹ 11,333 (A) | MYV ₹ 66,667 (A)

Problem 3.7 (*Material Variances*)

80 kgs. of material A at a standard price of ₹ 2 per kg and 40 kgs of material B at a standard price of ₹ 5 per kg. were to be used to manufacture 100 kgs. of a chemical.

During a month, 70 kgs. of material *A* priced at ₹ 2.10 per kg. and 50 kgs. of material *B* priced at ₹ 4.50 per kg. were actually used and the output of the chemical was 102 kgs.

Find out the material variances. *(I.C.W.A. Inter)*

Solution

Basic calculations :

Material	St. cost of 100 kg. of output			Actual cost of 102 kg. of output		
	Qty.	Rate	Amount	Qty.	Rate	Amount
	kg.	₹	₹	kg.	₹	₹
A	80	2	160	70	2.10	147
B	40	5	200	50	4.50	225
	120 kg.		360	120 kg.		372

St. cost of actual output = $\frac{₹\ 360}{100\ kg} \times 102\ kg$ = ₹ 367.20

St. output price = ₹ 360 ÷ 100 kg = ₹ 3.60

Calculation of Variances

Material Cost Variance = St. cost of actual output – Actual cost
= 367.20 – 372 = **₹ 4.80 (A)**

Material Price Variance = (St. price – Actual price) × Actual quantity

A	= (2 – 2.10) × 70	= ₹ .7 (A)
B	= (5 – 4.50) × 50	= ₹ 25 (F)
		MPV = **₹ 18 (F)**

Material Mix Variance = (Revised St. Qty. – Actual Qty.) × *S.P.*

A	= (80 – 70) × 2	= ₹ 20 (F)
B	= (40 – 50) × 5	= ₹ 50 (A)
		MMV = **₹ 30 (A)**

Material Yield Variance = (Actual yield – St. yield) × St. output price

MYV = (102 – 100) × ₹ 3.60 = **₹ 7.20 (F)**

Note : SQ given is Revised St. Qty because the total of actual quantities of materials consumed and that of standard quantities is equal.

Check

MCV ₹ 4.80 (A)

MPV ₹ 18 (F) — MUV ₹ 22.80 (A)

MMV ₹ 30 (A) — MYV ₹ 7.20 (A)

Problem 3.8 *(Material Variances)*

The standard material cost for production of 100 kg. of Chemical *D* is made up of:

Chemical *A*	30 kg. @ ₹ 4.00 per kg.
Chemical *B*	40 kg. @ ₹ 5.00 per kg.
Chemical *C*	80 kg. @ ₹ 6.00 per kg.

In a batch, 500 kg. of Chemical *D* was produced from a mix of :

Chemical *A*	140 kg at a cost of ₹ 588
Chemical *B*	220 kg at a cost of ₹ 1,056
Chemical *C*	440 kg at a cost of ₹ 2,860

How do the yield, mix and the price factors contribute to the variance in the actual cost per 100 per kg. of Chemical *D* over the standard cost? *(B.Com., Hons. Delhi)*

Solution

Basic calculations : Variances are calculated for 100 kg. of Chemical *D* as required.

Material	*Standard for 100 kg.*			*Actual for 100 kg.*		
	Qty.	*Rate*	*Amt.*	*Qty.*	*Rate*	*Amt.*
	Kg.	₹	₹	Kg.	₹	₹
A	30	4	120	28	4.20	117.60
B	40	5	200	44	4.80	211.20
C	80	6	480	88	6.50	572.00
Total	150		800	160		900.80

Actual price per kg $A = \frac{588}{140}$ = ₹ 4.20; $B = \frac{1,056}{220}$ = ₹ 4.80 $C = \frac{2,860}{440}$ = ₹ 6.50

Actual quantity per 100 kg Chemical *D*

$A = \frac{140}{5}$ = 28 kg.; $B = \frac{220}{5}$ = 44 kg.; $C = \frac{440}{5}$ = 88 kg.

Calculation of Variances

Material Cost Variance = *SC* − *AC* = 800 − 900.80 = **₹ 100.80 (A)**

Material Price Variance = (*SP* − *AP*) × *AQ*

A	= (4 − 4.20) × 28	= ₹ 5.60 (A)
B	= (5 − 4.80) × 44	= ₹ 8.80 (F)
C	= (6 − 6.50) × 88	= ₹ 44.00 (A)
		MPV **= ₹ 40.80 (A)**

Material Usage Variance = (*SQ* − *AQ*) × *SP*

A	= (30 − 28) × 4	= ₹ 8 (F)
B	= (40 − 44) × 5	= ₹ 20 (A)
C	= (80 − 88) × 6	= ₹ 48 (A)
		MUV **= ₹ 60 (A)**

Material Mix Variance = (*RSQ* − *AQ*) × *SP*

A	= (32 − 28) × 4	= ₹ 16.00 (F)
B	$= (42\frac{2}{3} - 44) \times 5$	= ₹ 6.65 (A)
C	$= (85\frac{1}{3} - 88) \times 6$	= ₹ 16.02 (A)
		MMV **= ₹ 6.67 (A)**

RSQ (Revised St. Quantity) is computed as below :

$$A = \frac{160}{150} \times 30 = 32 \text{ kg} \qquad C = \frac{160}{150} \times 80 = 85\frac{1}{3} \text{ kg}$$

$$B = \frac{160}{150} \times 40 = 42\frac{2}{3} \text{ kg}$$

Material Yield Variance = $(AY - SY) \times$ St. output price

$$MYV = (100 - 106\frac{2}{3}) \times 8 = ₹\ 53.33 \text{ (A)}$$

$$\text{St. yield} = \frac{160}{150} \times 100 = 106\frac{2}{3}$$

St. output price = ₹ 800 ÷ 100 kg. = ₹ 8

Problem 3.9 (*Material Variances*)

PK Chemicals Ltd. Manufactures *PXE* by mixing three raw materials. For each batch of 100 kg. of *PXE*, 125 kg. of raw materials are used. In March 60 batches are prepared to produce an output of 5600 kg of *PXE*. The standard and actual particulars for June are as follows :

Raw materials	*Standard*		*Actual*		*Quantity of raw materials purchased kg.*
	Mix. %	*Price per kg.* ₹	*Mix %*	*Price per kg.* ₹	
A	50	20	60	21	5000
B	30	10	20	8	2000
C	20	5	20	6	1200

Calculate all variances *(B.Com., Hons. Delhi)*

Solution

Basic calculations

Material	*Standard for 6,000 kg output*			*Actual for 5,600 kg output*		
	Kg. ₹	*Rate* ₹	*Amt.*	*Kg.* ₹	*Rate* ₹	*Amt.*
A	3,750	20	75,000	4,500	21	94,500
B	2,250	10	22,500	1,500	8	12,000
C	1,500	5	7,500	1,500	6	9,000
Total	7,500		1,05,000	7,500		1,15,500

Standard cost of actual output = $\frac{₹\ 1,05,000}{6,000 \text{ Kg.}} \times 5,600 \text{ Kg.} = ₹\ 98,000$

Material Cost Variance = SC of actual output – *AC*

MCV = 98,000 – 1,15,500 = **₹17,500 (A)**

Material Price Variance = $(SP - AP) \times AQ$

A = (20 – 21) × 4,500 = ₹ 4,500 (A)

B = (10 – 8) × 1,500 = ₹ 3,000 (F)

C = (5 – 6) × 1,500 = ₹ 1,500 (A)

MPV = **₹ 3,000 (A)**

Material Usage Variance = (*SQ* for actual output − *AQ*) × *SP*

$$A = \left(\frac{3,750}{6,000} \times 5,600 - 4,500\right) \times 20$$

$= (3500 - 4500) \times 20$ = ₹ 20,000 (A)

$$B = \left(\frac{2,250}{6,000} \times 5,600 - 1,500\right) \times 10$$

$= (2100 - 1500) \times 10$ = ₹ 6,000 (F)

$$C = \left(\frac{1,500}{6,000} \times 5,600 - 1,500\right) \times 5$$

$= (1400 - 1500) \times 5$ = ₹ 500 (A)

***MUV* = ₹14,500 (A)**

Material Mix Variance = (Revised *SQ* − *AQ*) × *SP*

A = (3,750 − 4,500) × 20 = ₹ 15,000 (A)

B = (2,250 − 1,500) × 10 = ₹ 7,500 (F)

C = (1,500 − 1,500) × 5 = ₹ Nil

***MMV* = ₹ 7,500 (A)**

Material Yield Variance = (Actual yield − St. yield) × St. output cost per unit

$$MYV = (5,600 - 6,000) \times \frac{1,05,000}{6,000} = ₹\ 7,000\ (A)$$

Note: In the question, quantity of material purchased is given. It does not give quantity of material consumed. It is thus assumed that quantity actually used is 7,500 units. In case of material *C*, it has been assumed that 300 units @ 6 were opening stock because purchased quantity is only 1,200 kg. while consumed quantity is 1,500 kg.

Problem 3.10 (*Material Variances*)

The standard material input required for 1,000 kgs of a finished product are given below:

Material	*Quantity* kg	*St. rate per kg.* ₹
P	450	20
Q	400	40
R	250	60
	1,100	
Standard loss	100	
Standard output	1,000	

Actual production in a period was 20,000 kg. of finished product for which the actual quantities of material used and the prices paid thereof were as under:

Material	*Quantities (Kg.)*	*Purchase price per kg.* ₹
P	10,000	19
Q	8,500	42
R	4,500	65

Calculate (*i*) Material Cost Variance (*ii*) Material Price Variance (*iii*) Material Usage Variance (*iv*) Material Mix Variance (*v*) Material Yield Variance.

Present a reconciliation among the variances. *(I.C.W.A. Inter)*

Solution

Basic calculations :

Material	Standard for 20,000 kg output			Actual for 20,000 kg. output		
	Qty. (kg)	Rate ₹	Amt. ₹	Qty. (kg)	Rate ₹	Amt. ₹
P	9,000	20	1,80,000	10,000	19	1,90,000
Q	8,000	40	3,20,000	8,500	42	3,57,000
R	5,000	60	3,00,000	4,500	65	2,92,500
	22,000		8,00,000	23,000		8,39,500
Less: Loss	2,000			3,000		
	20,000			20,000		

Calculation of Variances

(*i*) **Material Cost Variance** = *SC* − *AC*

MCV = 8,00,000 − 8,39,500 = **₹39,500 (A)**

(*ii*) **Material Price Variance** = (*SP* − *AP*) × *AQ*

P = (20 − 19) × 10,000 = ₹ 10,000 (F)

Q = (40 − 42) × 8,500 = ₹ 17,000 (A)

R = (60 − 65) × 4,500 = ₹ 22,500 (A)

MPV = **29,500 (A)**

(*iii*) **Material Usage Variance** = (*SQ* − *AQ*) × *SP*

P = (9,000 − 10,000) × 20 = ₹ 20,000 (A)

Q = (8,000 − 8,500) × 40 = ₹ 20,000 (A)

R = (5,000 − 4,500) × 60 = ₹ 30,000 (F)

MUV = **₹10,000 (A)**

(*iv*) **Material Mix Variance** = (*RSQ** − *AQ*) × *SP*

$$P = \left(23,000 \times \frac{9,000}{22,000} - 10,000\right) \times 20 = ₹\ 11,818\ (A)$$

$$Q = \left(23,000 \times \frac{8,000}{22,000} - 8,500\right) \times 40 = ₹\ 5,455\ (A)$$

$$R = \left(23,000 \times \frac{5,000}{22,000} - 4,500\right) \times 60 = ₹\ 43,636\ (F)$$

MMV = **26,363 (F)**

(*v*) **Material Yield Variance** = (*AY* − *SY*) × St. output price

$$= \left(20,000 - 23,000 \times \frac{20,000}{22,000}\right) \times \frac{8,00,000}{20,000}$$

$$MYV = \left(20,000 - \frac{4,60,000}{22}\right) \times 40 = ₹\ 36,363\ (A)$$

Reconciliation

(*i*) *MCV* = *MPV* + *MUV*

39,500 (A) = 29,500 (A) + 10,000 (A)

(*ii*) *MCV* = *MPV* + *MMV* + *MYV*

39,500 (A) = 29,500 (A) + 26,363 (F) + 36,363 (A)

Problem 3.11 (*Material Variances*)

Philips Ltd. produces an article by blending two basic raw materials. The following standards have been set up for raw material.

Material	*Standard Mix*	*St. Price per kg.*
A	40%	₹ 4
B	60%	₹ 3

The standard loss in processing is 15%. During September 2017 the company produced 1,700 kg. of finished output. The position of stock and purchases for the month of September 2017 is as under :

Material	*Stock on 1-9-2017*	*Stock on 30-9-2017*	*Purchases during Sep. 2017*	
	Kg.	Kg.	Kg.	Cost ₹
A	35	5	800	3,400
B	40	50	1,200	3,000

Calculate all material variances assuming FIFO method of issue of materials. The opening stock is to be valued at standard price. (*B.Com. Hons. Delhi*)

Solution

Basic calculations :

(*i*) **Calculation of standard quantity** = $1,700 \times \frac{100}{85} = 2,000$ kg.

Material *A* = 2,000 × 40% = 800 kg.

Material *B* = 2,000 × 60% = 1,200 kg.

(*ii*) **Actual consumption of materials**

Material	*Op. stock*	+	*Purchases*	–	*Closing stock*	=	*Consumption*
A	35 kg.	+	800 kg.	–	5 kg.	=	830 kg.
B	40 kg.	+	1,200 kg.	–	50 kg.	=	1,190 kg.

(*iii*) **Calculation of actual price per kg.**

Material $A = \frac{3,400}{800} = ₹\ 4.25$ $B = \frac{3,000}{1,200} = ₹\ 2.50$

UniBuddies'

(iv) Calculation of standard and actual cost of actual output

Material	Standard			Actual			
	Qty kg.	Rate ₹	Amount ₹	Qty. kg.	₹	Rate kg.	Amount ₹
A	800	4	3,200	35		4.00	140
				795	830	4.25	3378.75
B	1,200	3	3,600	40		3.00	120
				1,150	1,190	2.50	2,875
	2,000				2,020		
Loss	300				320		
	1,700		6,800		1,700		6,513.75

Calculation of Variances

(a) **Material Cost Variance** = Standard cost – Actual cost

MCV = 6,800 – 6,513.75 = **₹286.25 (F)**

(b) **Material Price Variance** = (SP – AP) × AQ

A = [(4 – 4) × 35] + [4 – 4.25) × 795] = ₹ 198.75 (A)

B = [(3 – 3) × 40] + [(3 – 2.50) × 1,150] = ₹ 575.00 (F)

MPV = **₹376.25 (F)**

(c) **Material Usage Variance** = (*SQ* – *AQ*) × *SP*

A = (800 – 830) × 4 = ₹ 120 (A)

B = (1,200 – 1,190) × 3 = ₹ 30 (F)

MUV = **₹ 90 (A)**

(d) **Material Mix Variance** = (RSQ – AQ) × SP

A = (808 – 830) × 4 = ₹ 88 (A)

B = (1,212 – 1,190) × 3 = ₹ 66 (F)

MMV = **₹ 22 (A)**

RSQ – $A = \frac{2,020}{2,000} \times 800 = 808$ kg.

$B = \frac{2,020}{2,000} \times 1,200 = 1,212$ kg.

(e) **Material Yield Variance** = (Actual yield – St. yield) × St. output price

$MYV = (1,700 - 1,717) \times \frac{6,800}{1,700}$ = **₹ 68 (A)**

St. yield $= \frac{85 \text{ kg}}{100 \text{ kg}} \times 2,020 = 1,717$ Kg.

Check

MCV = *MPV* + *MMV* + *MYV*

286.25 (F) = 376.25(F) + 22 (A) + 68 (A)

UniBuddies'

Problem 3.12 (*Material Variances*)

XYZ Ltd has established the following standard mix for producing 9 gallons of product '*A*' :

	₹
5 gallons – Material *X* at ₹ 7 per gallon	35
3 gallons – Material *X* at ₹ 5 per gallon	15
2 gallons – Material *Z* at ₹ 2 per gallon	4
	₹ 54

A standard loss of 10% of input is expected to occur. Actual input was :

Material *X* – 53,000 gallons at ₹ 7 per gallon
Material *X* – 28,000 gallons at ₹ 5.30 per gallon
Material *Z* – 19,000 gallons at ₹ 2.20 per gallon

Actual output for the period was 92,700 gallons.

Calculate: (*i*) Material Mix Variance, and (*ii*) Material Yield Variance. (*B.Com. Hons., Delhi*)

Solution

Basic calculations

	Standard Cost			*Actual Cost*		
	Qty. *Gallons*	*Rate* ₹	*Amt.* ₹	*Qty.* *Gallons*	*Rate* ₹	*Amt.* ₹
X	50,000	7	3,50,000	53,000	7.00	3,71,000
Y	30,000	5	1,50,000	28,000	5.30	1,48,400
Z	20,000	2	40,000	19,000	2.20	41,800
	1,00,000		5,40,000	1,00,000		5,61,200
Less: Loss	10,000			7,300		
Output	90,000			92,700		

Material Mix Variance = (Revised *SQ* – *AQ*) × *SP*

X = (50,000 – 53,000) × 7 = ₹ 21,000 (A)
Y = (30,000 – 28,000) × 5 = ₹ 10,000 (F)
Z = (20,000 – 19,000) × 2 = ₹ 2,000 (F)
MMV = ₹ 9,000 (A)

Material Yield Variance = (*AY* – *SY*) × St. output price

$$= (92{,}700 - 90{,}000) \times \frac{₹\ 5{,}40{,}000}{90{,}000 \text{ gallons}}$$

MYV = 2,700 × 6 = **₹ 16,200 (F).**

Problem 3.13 (*Material and Labour Variances*)

From the particulars given below, compute: Material Price Variance, Material Usage Variance, Labour Rate Variance, Idle Time Variance and Labour Efficiency Variance with full working details.

One tonne of materials input yields a standard output of 1,00,000 units. The standard price of material is ₹ 20 per kg. Number of employees engaged is 200. The standard wage rate per employee per day is ₹ 6. The standard daily output per employee is 100 units. The actual

quantity of material used is 10 tonnes and the actual price paid is ₹ 21 per kg. Actual output obtained is 9,00,000 units. Actual number of days worked is 50 and actual rate of wages paid is ₹ 6.50 per day. Idle time paid for and included in above time is 1/2 day. *(C.A. Inter)*

Solution

1 tonne = 1,000 kg.

Material Price Variance = $(SP - AP) \times AQ$
= (20 – 21) × 10,000 kg. = **₹ 10,000 (A)**

Material Usage Variance = $(SQ - AQ) \times SP$
= (9,000 kg – 10,000 kg) × ₹ 20 = **₹ 20,000 (A)**

Labour Rate Variance = (St. rate – Actual rate) × Actual days
= (6 – 6.50) × 10,000 = **₹ 5,000 (A)**

Note : Actual days = 200 employees × 50 days = 10,000

Labour Efficiency Variance = (St. days – Actual days) × St. rate
= (9,000 – 9,900) × 6 = **₹ 5,400 (A)**

Idle Time Variance = Idle days × St. rate
= (200 employees × ½) × ₹ 6 = **600 (A)**

Problem 3.14 (*Material and Labour Variances*)

The standard cost on 'Material' and 'Labour' for the making of a unit of a certain product are estimated as under :

Material	80 kg. at ₹ 1.50 per kg.
Labour	18 hrs. at ₹ 1.25 per hr.

On completion of the production of a unit, it was found that 75 kg. of material costing ₹ 1.75 per kg. has been consumed and that the time taken was 16 hours, the wage rate being ₹ 1.50 per hour.

You are required to analyse material and labour variances. *(B.Com., Hons. Delhi)*

Solution

Material Variances :

Material Cost Variance = Standard cost – Actual cost
= $(SP \times SQ) - (AP \times AQ)$
= (₹ 1.50 × 80 kg.) – (₹ 1.75 × 75 kg.)
= ₹ 120 – ₹ 131.25 = **₹ 11.25 (A)**

Material Price Variance = $(SP - AP) \times AQ$
= (1.50 – 1.75) × 75 = **₹ 18.75 (A)**

Material Usage Variance = $(SQ - AQ) \times SP$
= (80 – 75) × 1.50 = **₹ 7.50 (F)**

Labour Variances :

Labour Cost Variance = Standard cost – Actual cost
= $(SR \times SH) - (AR \times AH)$
= (1.25 × 18) – (1.50 × 16) = **₹ 1.50 (A)**

Labour Rate Variance = $(SR - AR) \times AH$
= (1.25 – 1.50) × 16 = **₹ 4 (A)**

Labour Efficiency Variance = $(SH - AH) \times SR$
= (18 – 16) × 1.25 = **₹ 2.50 (F)**

Problem 3.15 (*Labour Variances*)

From the following, calculate labour variances for department *A* and *B*.

	Dept. *A*	Dept. *B*
Actual direct wages	₹ 2,000	₹ 1,800
Standard hours produced	8,000	6,000
Standard rate per hour	30 paise	35 paise
Actual hours worked	8,200	5,800

(*I.C.W.A. Inter*)

Solution

Labour Cost Variance = $SC - AC$

Dept. *A* = (8,000 × 0.30) − 2,000 = ₹ **400 (F)**

Dept. *B* = (6,000 × 0.35) − 1,800 = ₹ **300 (F)**

Labour Rate Variance = $(SR - AR) \times AH$

Dept. *A* = $\left(0.30 - \frac{2,000}{8,200}\right) \times 8,200$ = ₹ **460 (F)**

Dept. *B* = $\left(0.35 - \frac{1,800}{5,800}\right) \times 5,800$ = ₹ **230 (F).**

Labour Efficiency Variance = (SH − AH) × SR

Dept. *A* = (8,000 − 8,200) × 0.30 = ₹ **60 (A)**

Dept. *B* = (6,000 − 5,800) × 0.35 = ₹ **70 (F)**

Check

Labour Cost Variance = Rate Variance + Efficiency Variance

Dept. *A* 400 (F) = 460 (F) + 60 (A)

Dept. *B* 300 (F) = 230 (F) + 70 (F)

Problem 3.16 (*Labour Variances*)

Standard hours for manufacturing two products *M* and *N* are 15 hours per unit and 20 hours per unit respectively. Both products require identical kind of labour and the standard wage rate per hour is ₹ 5. In a year 10,000 units of *M* and 15,000 units of *N* were manufactured. The total of labour hours actually worked were 4,50,500 and the actual wage bill came to ₹ 23,00,000. This included 12,000 hours paid for @ ₹ 7 per hour and 9,400 hours paid for @ ₹ 7.50 per hour, the balance having been paid at ₹ 5 per hour. You are required to compute the labour variances.

(*B.Com Hons Delhi, I.C.W.A. Inter*)

Solution

Labour Cost Variance = Standard cost for actual output − Actual cost.

Standard cost :

For product *M* = 10,000 units × 15 hrs. × ₹ 5 = ₹ 7,50,000

For product *N* = 15,000 units × 20 hrs. × ₹ 5 = ₹ 15,00,000

Total standard cost = ₹ 22,50,000

Total actual cost = ₹ 23,00,000

Labour cost variance = ₹ 22,50,000 − ₹ 23,00,000 = **₹50,000 (A)**

Labour Efficiency Variance = (St. hrs. – Actual hrs.) × St. rate
= (4,50,000 – 4,50,500) × 5 = ₹ 2,500 (A)

Labour Rate Variance = (St. rate – Actual rate) × Actual hrs.
= [(5 – 7) × 12,000] + [(5 – 7.50) × 9,400] + [(5 – 5) × 4,29,100]
= ₹47,500 (A)

Problem 3.17 (Labour Variances)

The details regarding the composition and the weekly wage rates of labour force engaged on a job scheduled to be completed in 30 weeks are as follows :

Category of workers	Standard		Actual	
	No. of workers	Weekly wage rate per worker	No. of workers	Weekly wage rate per worker
Skilled	75	₹ 60	70	₹ 70
Semi-skilled	45	₹ 40	30	₹ 50
Unskilled	60	₹ 30	80	₹ 20

The work is actually completed in 32 weeks. Calculate the all labour variances.

(B.Com. Hons., Delhi)

Solution

Basic calculations:

Category of workers	Standard			Actual		
	Weeks (No. of workers × No. of weeks	Rate ₹	Amt. ₹	Weeks (No. of workers × No. of weeks)	Rate ₹	Amount ₹
Skilled	75 × 30 = 2,250	60	1,35,000	70 × 32 = 2,240	70	1,56,800
Semi-skilled	45 × 30 = 1,350	40	54,000	30 × 32 = 960	50	48,000
Unskilled	60 × 30 = 1,800	30	54,000	80 × 32 = 2,560	20	51,200
Total	5,400		2,43,000	5,760		2,56,000

Calculation of Variances

Labour Cost Variance = (*SC – AC*)
= 2,43,000 – 2,56,000 = **₹13,000 (A)**

Labour Rate Variance= (*Standard rate – Actual rate*) × *Actual time*

Skilled = (60 – 70) × 2,240 = ₹ 22,400 (A)
Semi-skilled = (40 – 50) × 960 = ₹ 9,600 (A)
Unskilled = (30 – 20) × 2,560 = ₹ 25,600 (F)
LRV = **₹ 6400 (A)**

Labour Efficiency Variance = (*Standard time – Actual time*) × *Standard rate.*

Skilled = (2,250 – 2,240) × 60 = ₹ 600 (F)
Semi-skilled = (1,350 – 960) × 40 = ₹ 15,600 (F)
Unskilled = (1,800 – 2,560) × 30 = ₹ 22,800 (A)
LEV = **₹ 6,600 (A)**

Labour Mix Variance = (**Revised standard time – Actual time*) × *Standard rate*

Skilled	= (2,400 – 2,240) × 60	= ₹ 9,600 (F)
Semi-skilled	= (1,440 – 960) × 40	= ₹ 19,200 (F)
Unskilled	= (1,920 – 2,560) × 30	= ₹ 19,200 (A)
		LMV = **₹ 9,600 (F)**

*Revised standard time is calculated as under.

$$\text{Revised Standard time} = \frac{\text{St. time of grade}}{\text{Total standard time}} \times \text{Total actual time}$$

$$\text{Skilled} = \frac{2,250}{5,400} \times 5,760 = 2,400 \text{ weeks}$$

$$\text{Semi-skilled} = \frac{1,350}{5,400} \times 5,760 = 1,440 \text{ weeks}$$

$$\text{Unskilled} = \frac{1,800}{5,400} \times 5,760 = 1,920 \text{ weeks.}$$

Labour Revised Efficiency Variance = (*St. time – Revised st. time*) × *S.R.*

Skilled	= (2,250 – 2,400) × 60	= ₹ 9,000 (A)
Semi-skilled	= (1,350 – 1,440) × 40	= ₹ 3,600 (A)
Unskilled	= (1,800 – 1,920) × 30	= ₹ 3,600 (A)
		LREV = **₹16,200 (A)**

Alternative to LREV

Labour Yield Variance = (*AY – SY*) × *SOR*

$$\text{LYV} = \left(1 - \frac{5,760}{5,400}\right) \times ₹\ 2,43,000 = \textbf{₹ 16,200 (A)}$$

Check

(*i*) *LCV* = *LRV* + *LEV*

₹ 13,000 (A) = ₹ 6,400 (A) + ₹ 6,600 (A)

(*ii*) *LEV* = *LMV* + *LREV (Or LYV)*

₹ 6,600 (A) = ₹ 9,600 (F) + ₹ 16,200 (A)

Problem 3.18 (*Variances Analysis*)

In a factory 100 workers are employed and standard average wage rate is ₹ 50 per hour. Standard working hours per week are 40 and the standard performance is 10 units per hour.

During a week, wages paid for 50 workers are at the rate of ₹ 50 per hour, 10 workers at ₹ 70 per hour and 40 workers at ₹ 40 per hour. Actual output was 380 units. The factory did not work for 5 hours due to break down of machinery.

Calculate : (i) Labour cost variance (ii) Labour rate variance
(iii) Labour efficiency variance and (iv) Idle time variance.
Also verify your answers. *(B.Com. Hons, Delhi)*

Solution :

(i) **Labour Cost Variance** = SC – AC

= (SH for actual output × SR) – (AH × AR)

$$= \left(\frac{380 \text{ units} \times 100 \text{ workers} \times ₹\ 50}{10 \text{ units}}\right) - \{(50 \text{ workers} \times 40 \text{ hrs} \times ₹\ 50)$$

$$+ (10 \text{ workers} \times 40 \text{ hrs} \times ₹\ 70) + (40 \text{ workers} \times 40 \text{ hrs} \times ₹\ 40)\}$$

LCV = ₹ 1,90,000 – (1,00,000 + 28,000 + 64,000) = **₹ 2,000** (A)

(ii) **Labour Rate Variance** = (SR – AR) × AH

(₹ 50 – 50) × 50 workers × 40 hrs. = Nil

(₹ 50 – 70) × 10 workers × 40 hrs. = ₹ 8,000 (A)

(₹ 50 – 40) × 40 workers × 40 hrs. = ₹ 16,000 (F)

LRV = **₹ 8,000 (F)**

(iii) **Labour Efficiency Variance** = (SH – AH) × SR

$$\left\{380 \times \frac{100}{10} - (100 \times 40 - 500 \text{ Idle hrs.})\right\} \times ₹\ 50 = ₹\ 15,000\ (F)$$

(iv) **Idle Time Variance** = Idle hours × SR

= 5 hrs × 100 workers × ₹ 50 = **₹ 25,000 (A).**

Note : Idle Time Variance has been calculated as sub-variance of LCV.

Check

$$LCV = LRV + LEV + ITV$$

₹ 2,000(A) = ₹ 8,000 (F) + ₹ 15,000 (F) + ₹ 25,000 (A)

Problem 3.19 (*Labour Variances*)

The standard output of '*X*' is 25 units per hour in a manufacturing department of a company employing 100 workers. The standard wage rate per labour hour is ₹ 6.

In a 42 hour week, the department produced, 1,040 units of '*X*' despite 5% of the time paid was lost due to abnormal reason. The hourly rate actually paid were ₹ 6.20, ₹ 6 and ₹ 5.70 respectively to 10, 30 and 60 workers. Compute relevant variances. (*C.A. Inter*)

Solution

Basic calculations :

Standard hours per unit = 100 ÷ 25 = 4

Standard hours for actual output = 1,040 units × 4 hours = 4,160

Standard cost of actual output = 4,160 hrs × ₹ 6 = ₹ 24,960

Actual cost is calculated as follows :

No. of workers	*Actual hours paid**	*Idle hours*	*Effective hours*	*Rate per hour* ₹	*Amount.* ₹
10	420	21	399	6.20	2,604
30	1,260	63	1,197	6.00	7,560
60	2,520	126	2,394	5.70	14,364
Total	4,200	210	3,990		24,528

*Actual hours paid is No. of workers × 42 hours.

Calculation of Variances

Labour Cost Variance	= St. cost – Actual cost = 24,960 – 24,528	= ₹ 432 (F)
Labour Efficiency Variance	= (*SH – AH*) × *SR* = (4,160 – 3,990) × 6	= ₹ 1,020 (F)
Labour Rate Variance	= (*SR – AR*) × *AH* = [(6 – 6.20) × 420] + [(6 – 6) × 1,260] + [(6 – 5.70) × 2,520)] = 84 (A) + Nil + 756 (F)	= ₹ 672 (F)
Idle Time Variance	= Idle hours × St. rate = 210 × 6	= ₹ 1,260 (A)

Check

Labour cost variance = Efficiency variance + Rate variance + Idle time variance

432 (F) = 1,020 (F) + 672 (F) + 1,260 (A)

Note : Idle time variance has been calculated as *a* sub-variance of labour cost variance. Alternatively, it may be calculated as a sub-variance of efficiency variance.

Problem 3.20 (*Labour Variances*)

A group of 10 skilled and 20 unskilled workers were expected to produce 400 kg of Chemical BXT in an 8 hour day. The standard hourly wage rate was fixed at ₹ 25 and ₹ 15 respectively.

Actually, a group of 15 skilled and 10 unskilled workers was deployed and paid for 8 hour day at an hourly wage rate of ₹ 22 and ₹ 18 respectively. Two hours were wasted for the entire group due to power failure and only 300 kg of BXT was produced.

You are required to compute :

(*i*) Labour cost variance; (*ii*) Labour rate variance; (*iii*) Idle time variance; (*iv*) Labour usage variance; (*v*) Labour mix variance (*vi*) Labour yield variance (*B.Com. Hons., Delhi*)

Solution

Basic calculations:

Type of worker	*Standard for 400 kg*			*Actual for 300 kg.*		
	*Hrs.**	*Rate* ₹	*Amt.* ₹	*Hrs.**	*Rate* ₹	*Amt.* ₹
Skilled	80	25	2,000	120	22	2,640
Unskilled	160	15	2,400	80	18	1,440
	240		4,400	200		4,080

*Hrs. = No. of workers × 8 hrs.

Standard cost of actual output (SC) = $\frac{4,400}{400} \times 300$ = ₹ 3,300

Labour cost variance = SC – AC

LCV = 3,300 – 4,080 = ₹ 780 (A)

Labour Rate Variance = (SR – AR) × AH

Skilled	= (25 – 22) × 120	= ₹ 360 (F)
Unskilled	= (15 – 18) × 80	= ₹ 240 (A)
		LRV = ₹ **120 (F)**

Labour Efficiency Variance = (SH* – AH) × SR

Skilled	= (60 – 120) × 25	= ₹ 1,500 (A)
Unskilled	= (120 – 80) × 15	= ₹ 600 (F)
		LRV = ₹ **900 (A)**

*SH St. hours for actual output are calculated as under :

$$\text{Skilled} = \frac{80 \text{ hrs}}{400 \text{ kg}} \times 300 \text{ kg} = 60 \text{ hrs.}$$

$$\text{Unskilled} = \frac{160 \text{ hrs}}{400 \text{ kg}} \times 300 \text{ kg} = 120 \text{ hrs.}$$

Ideal Time Variance = Idle hrs × St. rate

Skilled	= 15 workers × 2 hrs × ₹ 25	= ₹ 750 (A)
Unskilled	= 10 workers × 2 hrs × ₹ 15	= ₹ 300 (A)
	ITV	= ₹ **1050 (A)**

*Idle time variance is calculated as a sub-variance of labour efficiency variance. Now LMV and LXV hour been calculated after deducting idle hrs. from actual hours.

Labour Mix Variance = (RSH* – AH*) × SR

Skilled	= (50 – 90) × 25	= ₹ 1,000 (A)
Unskilled	= (100 – 60) × 15	= ₹ 600 (F)
	LMV	= ₹ **400 (A)**

* Actual hours = Original actual hours – Idle hrs.

Skilled	= 120 – 30 = 90 hrs
Unskilled	= 80 – 20 = 60 hrs
Total	= 150 hrs

* RSH (Revised standard hours)

$$\text{Skilled} = 150 \times \frac{80}{240} = 50$$

$$\text{Skilled} = 150 \times \frac{80}{240} = 100$$

Labour Yield Variance = (AY – SY) × SOR

$$= \left(300 - 150 \times \frac{400}{240}\right) \times \frac{4400}{400} = ₹ \textbf{ 550 (F)}$$

Problem 3.21 (*Labour Variances*)

A gang of workers normally consists of 30 men, 15 women and 10 boys. They are paid at standard rates per hour as Man—₹ 0.80, Woman—₹ 0.60, Boy—₹ 0.40.

In a normal working week of 40 hours, the gang is expected to produce 2,000 units of output.

During the week ended 31 December, the gang consisted of 40 men, 10 women and 5 boys. The actual wages paid were @ ₹ 0.70, ₹ 0.65 and ₹ 0.30 respectively. 1,600 units were produced. Four hours were lost due to abnormal idle time.

Calculate (*i*) Wage variance, (*ii*) Wage rate variance, (*iii*) Labour efficiency variance, (*iv*) Idle time variance (*v*) Gang composition variance, (*i.e.*, labour mix variance) and (*vi*) Labour revised efficiency variance, or Labour yield variance. *(B.Com. Hons., Delhi)*

Solution

Basic calculations:

Type of worker	*Standard*			*Actual*		
	*Hrs.**	*Rate* ₹	*Amt.* ₹	*Hrs.**	*Rate* ₹	*Amt.* ₹
Men	1,200	0.80	960	1,600	0.70	1,120
Women	600	0.60	360	400	0.65	260
Boys	400	0.40	160	200	0.30	60
Total	2,200		1,480	2,200		1,440

*Hrs. = No. of workers × Weekly 40 hours

SC of actual output $= \frac{1,600}{2,000} \times 1,480 =$ ₹ 1,184

Standard hours (SH) for actual output :

Men $= \times \frac{1,200}{2000}\ 1,600 = 960$ Boys $= \frac{400}{2,000} \times 1,600 = 320$

Women $= \times \frac{600}{2,000}\ 1,600 = 480$

Calculation of Variances

(*i*) **Wage Variance** (Labour cost variance) = (SC of actual output) – (Actual cost)
= 1,184 – 1,440 = **₹ 256 (A)**

(*ii*) **Labour or Wage Rate Variance** = (*SR* – *AR*) × *AH*

Men = (0.80 – 0.70) × 1,600 = ₹ 160 (F)
Women = (0.60 – 0.65) × 400 = ₹ 20 (A)
Boys = (0.40 – 0.30) × 200 = ₹ 20 (F)
LRV = **₹ 160 (F)**

(*iii*) **Labour Efficiency Variance** = (*SH* for actual output – *AH*) × *SR*

Men = (960 – 1,600) × 0.80 = ₹ 512 (A)
Women = (480 – 400) × 0.60 = ₹ 48 (F)
Boys = (320 – 200) × 0.40 = ₹ 48 (F)
LEV = **₹ 416 (A)**

Note: Here Idle Time Variance is treated as a sub-variance of labour efficiency variance. Thus labour efficiency variance may be segregated into idle time variance, mix variance and yield variance.

(*iv*) **Idle Time Variance** = Standard rate per hour × Idle hours*

Men = ₹ 0.80 × 160 = ₹ 128 (A)

Women = ₹ 0.60 × 40 = ₹ 24 (A)
Boys = ₹ 0.40 × 20 = ₹ 8 (A)
ITV = **₹160 (A)**

Calculation of idle hours

Men	= 40 × 4 hrs = ₹	160
Women	= 10 × 4 hrs = ₹	40
Boys	= 5 × 4 hrs = ₹	20
Total	=	220

Actual hours after idle hours are :

Men	= 1600 – 160	= ₹1440 hrs.
Women	= 400 – 40	= ₹ 360 hrs.
Boys	= 200 – 20	= ₹ 180 hrs.
Total	= 2,200 – 220	= **₹1,980 hrs.**

Now RSH for the purpose of labour mix variance and labour yield variance are computed on the basis of 1,980 actual hours *i.e.* 1980 hrs in the ratio of st. hours of 1200 : 600 : 400.

(v) **Labour Mix Variance** = *(RSH – AH) × SR*

Men = (1,080 – 1,440) × 0.80 = ₹ 288 (A)
Women = (540 – 360) × 0.60 = ₹ 108 (F)
Boys = (360 – 180) × 0.40 = ₹ 72 (F)
LMV = **₹108 (A)**

(iv) **Labour Revised Efficiency Variance** = *(RH – RSH) × SR*

Men = (960 – 1,080) × 0.80 = ₹ 96 (A)
Women = (480 – 540) × 0.60 = ₹ 36 (A)
Boys = (320 – 360) × 0.40 = ₹ 16 (A)
LREV = **₹148 (A)**

Labour Yield Variance may be calculated in place of Labour Revised Efficiency Variance :

Labour Yield Variance = (Actual yield – St. yield) × St. yield rate

$$LYV = (1,600 - 1,800) \times \frac{₹\ 1,480}{2,000 \text{ units}} = ₹148 \text{ (A)}$$

$$\text{Standard yield} = \frac{2,000}{2,200} \times 1,980 = 1,800 \text{ units}$$

Check

(i) *LCV = LRV + LEV* 256 (A) = 160 (*F*) + 416 (*A*)

(ii) *LEV = ITV + LMV + LYV* 416 (A) = 160 (*A*) + 108 (A) + 148 (*A*)

Problem 3.22 (*Materials and Labour Variances*)

From the following data of A Co. Ltd. relating to budgeted and actual performance for the month of March, compute direct materials and direct labour cost variances :

Budgeted data for March :

Units to be manufactured	1,50,000
Units of direct material required (based on standard rates)	4,95,000
Planned purchase of raw materials (units)	5,40,000
Average unit cost of direct material	₹ 8
Direct labour hours per unit of finished goods	3/4 hour
Direct labour cost (total)	₹ 29,92,500

Actual data at the end of March :

Units actually manufactured	1,60,000
Direct material cost (purchase cost based on units actually issued)	₹ 43,41,900
Direct material cost (purchase cost based on units actually purchased)	₹ 45,10,000
Average unit cost of direct material	8.20
Total direct labour hours for March	1,25,000
Total direct labour cost for March	33,75,000

(I.C.W.A., Inter)

Solution

Material Variances :

(a) **Material Cost Variance** = (*SC* – *AC*)

= (1,60,000 units × ₹ 8 × 3.30*) – 43,41,900 = **₹ 1,17,900 (A)**

*Standard material quantity per unit of finished product is :

= (4,95,000 ÷ 1,50,000) = 3.30 units

(b) **Material Price Variance** = (*SP* – *AP*) × *AQ*

= (8 – 8.20) × = **₹ 1,05,900 (A)**

(c) **Materials Usage Variance** = (*SQ* – *AQ*) × *SP*

$$= \left(1,60,000 \times 3.30 - \frac{43,41,900}{8.20}\right) \times 8 = ₹\ 12,000\ (A)$$

Labour Variances :

(a) **Labour Cost Variance** = *SC* – *AC*

= (1,60,000 × 19.95*) – 33,75,000 = **₹ 1,83,000 (A)**

* St. rate per unit = 29,92,500 ÷ 1,50,000 = ₹ 19.95

(b) **Labour Rate Variance** = (*SR* – *AR*) × *AH*

= (26.60 – 27) × 1,25,000 = **₹ 50,000 (A)**

St. rate per hour = [29,92,500 ÷ (1,50,000 × 3/4 hrs.)] = ₹ 26.60

Actual rate per hour = (33,75,000 ÷ 1,25,000) = ₹ 27

(c) **Labour Efficiency Variance** = (*SH* – *AH*) × *SR*

= (1,60,000 × 3/4 – 1,25,000) × 26.60 = **₹ 1,33,000 (A)**

Problem 3.23 (*Overhead Variances*)

From the following information compute Fixed Overhead Cost, Expenditure and Volume Variances.

Normal capacity is 5,000 hours. Budgeted fixed overhead rate is ₹ 10 per standard hour. Actual level of capacity utilised is 4,400 standard hours. Actual fixed overhead ₹ 52,000.

(B.Com. Hons., Delhi)

Solution

1. **Fixed Overhead Cost Variance**

= (*St. hrs. for actual output* × *St. ohd. rate*) – *Actual overhead*

= (4,400 × ₹ 10) – 52,000

= **₹ 8,000 (A)**

2. **Expenditure Variance**
Budgeted overhead – Actual overhead
= (5,000 × ₹ 10) – ₹ 52,000 = **₹ 2,000 (A)**

3. **Volume Variance**
(St. hrs. for actual output – Budgeted hrs) × St. overhead rate
(4,400 – 5,000) × ₹ 10 = **₹ 6,000 (A)**

Check
F.O. Cost Variance = Expenditure Variance + Volume Variance
₹ 8,000 (A) = ₹ 2,000 (A) + ₹ 6,000 (A)

Problem 3.24 (*Overhead Variances*)

A company operates a standard costing system and showed the following data for the month of March :

	Actual	*Budgeted*
No. of working days	22	20
Man-hours	4,300	4,000
Overhead rate per hour	—	₹ 0.50
Hours per unit of output	—	10
Fixed overhead incurred	₹ 1,800	—
No. of units produced	425	—

Calculate:
(*a*) Overhead Cost variance (*b*) Budget Variance
(*c*) Volume Variance (*d*) Capacity Variance
(*e*) Calender Variance (*f*) Efficiency Variance (*I.C.W.A. Inter*)

Solution

Basic Calculations :

1. Budgeted output = $\frac{4,000 \text{ hours}}{10 \text{ hours}}$ = 400 units
2. Budgeted overhead = 4,000 hrs. @ ₹ 0.50 = ₹ 2,000
3. Standard hours for actual output = 425 units @ 10 hrs. = 4,250
4. Absorbed overhead = 4,250 hrs. @ ₹ 0.50 = ₹ 2,125
5. Standard overhead = 4,300 hrs. × ₹ 0.50 = ₹ 2,150
6. Revised budgeted overhead = 4,000 hrs. × $\frac{22 \text{ days}}{20 \text{ days}}$ × 0.50 = ₹ 2,200
7. Revised budgeted hours = 4,000 × $\frac{22}{20}$ = 4,400 hrs.

Calculation of Variances

(*a*) **Overhead Cost Variance** = Absorbed overhead – Actual overhead
= 2,125 – 1,800 = **₹ 325 (F)**

(*b*) **Budget Variance** = Budgeted overhead – Actual overhead
= (2,000 – 1,800) = **₹ 200 (F)**

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(c) **Volume Variance** = Absorbed overhead – Budgeted overhead = ₹ 125 (F)
= (2,125 – 2,000)

(d) **Capacity Variance** = Standard overhead – Revised budgeted overhead = ₹ 50 (A)
= (2,150 – 2,200)

(e) **Calendar Variance** = (Revised budgeted hours – Budgeted hours) × St. rate = ₹ 200 (F)
= (4,400 – 4,000) × 0.50

(f) **Efficiency Variance** = Absorbed overhead – Standard overhead = ₹ 25 (A)
= (2,125 – 2,150)

Check

(i) Cost Variance = Budget Variance + Volume Variance
325 (F) = 200 (F) + 125 (F)

(ii) Volume Variance = Efficiency Variance + Capacity Variance + Calendar Variance
125 (F) = 25 (A) + 50 (A) + 200 (F)

Problem 3.25 (*Overhead Variances*)

CIPLA Ltd. has furnished you the following data:

	Budget	*Actual (July)*
Production in units	20,000	22,000
Fixed overheads	₹ 30,000	31,000
No. of working days	25	27

Budgeted fixed overhead rate is ₹ 1 per hour. In July, the actual hours worked were 31,500. Calculate overhead variances. (*C.A., Inter, Adapted*)

Solution

Basic calculations :

Budgeted hours = ₹ 30,000 ÷ ₹ 1= 30,000 hrs.

St. hours for actual output $= \frac{\text{Budgeted hours}}{\text{Budgeted output}} \times \text{Acutal output}$

$= \frac{30,000}{20,000} \times 22,000 = 33,000 \text{ hours}$

St. rate per day = ₹ 30,000 ÷ 25 days = ₹ 1,200

Recovered overhead = 33,000 hrs. × ₹ 1 = ₹ 33,000

Standard overhead = 31,500 hrs. × ₹ 1= ₹ 31,500

Revised budgeted hours (for 27 days) $= \frac{\text{Budgeted hours}}{\text{Budgeted days}} \times \text{Acutal days}$

$= \frac{30,000}{25} \times 27 = 32,400 \text{ hours}$

Revised budgeted overhead = 32,400 hrs. × ₹ 1 = ₹ 32,400

Calculation of Variances

(i) ***F.O.* Cost Variance** = Recovered overhead – Actual overhead = ₹ 2,000 (F)
= ₹ 33,000 – ₹ 31,000

(ii) **Expenditure Variance** = Budgeted overhead – Actual overhead = ₹ 1,000 (A)
= ₹ 30,000 – ₹ 31,000

(iii) **Volume Variance** = Recovered overhead – Budgeted overhead
= ₹ 33,000 – ₹ 30,000 = **₹ 3,000 (F)**

(iv) **Capacity Variance** = Standard overhead – Revised budgeted overhead
= ₹ 31,500 – ₹ 32,400 = **₹ 900 (A)**

(v) **Efficiency Variance** = Recovered overhead – Standard overhead
= ₹ 33,000 – ₹ 31,500 = **₹ 1,500 (F)**

(vi) **Calendar Variance** = (Actual days – Budgeted days) × St. rate per day
= (27 – 25) × 1,200 = **₹ 2,400 (F)**

Check

(i) *F.O.* Cost Variance = Expenditure Variance + Volume Variance
2,000 (F) = 1,000 (A) + 3,000 (F)

(ii) Volume Variance = Capacity Variance + Efficiency Variance + Calendar Variance
3,000 (F) = 900 (A) + 1,500 (F) + 2,400 (F)

Problem 3.26 (*Overhead Variances*)

The following data has been collected from the cost records of a unit for computing the various fixed overhead variances for a period :

Number of budgeted working days	25
Budgeted man-hours per day	6,000
Output (budgeted), per man-hour (in units)	1
Fixed overhead cost as budgeted	₹ 1,50,000
Actual number of working days	27
Actual man-hours per day	6,300
Actual output per man-hour (in units)	0.9
Actual fixed overhead incurred	₹ 1,56,000

Calculate fixed overhead variances :

(*a*) Expenditure Variance, (*b*) Calender Variance,
(*c*) Capacity Variance, (*d*) Efficiency Variance,
(*e*) Volume Variance, (*f*) Fixed Cost Variance. (*I.C.W.A. Inter*)

Solution

Basic Calculations :

1. Budgeted overhead (given)	= ₹ 1,50,000
2. Actual overhead (given)	= ₹ 1,56,000
3. Absorbed overhead (6,300 hrs. × 27 days × 0.90 × ₹ *1)	= ₹ 1,53,090
4. Standard overhead (6,300 hrs × 27 day × ₹ 1)	= ₹ 1,70,100
5. St. overhead rate per day (₹ 1,50,000 ÷ 25 days)	= ₹ 6,000
6. Revised budgeted overhead (₹ 6,000 × 27 days)	= ₹ 1,62,000

*St. overhead rate per hr. = ₹ 1,50,000 ÷ (6,000 hrs × 25 days) = ₹ 1.

Calculation of variances

(*a*) *Expenditure Variance* = Budgeted overhead – Actual overhead
= (1,50,000 – 1,56,000) = **₹ 6,000(A)**

(b) *Calendar Variance* = (Actual No. of days − St. No. of days) × St. overhead rate per day
= (27 − 25) × 6,000 = ₹ 12,000(F)

(c) *Capacity variance* = Standard overhead − Revised budgeted overhead
= (1,70,100 − 1,62,000) = ₹ 8,100(F)

(d) *Efficiency Variance* = Absorbed overhead − Standard overhead
= (1,53,090 − 1,70,100) = ₹ 17,010(A)

(e) *Volume Variance* = Absorbed overhead − Budgeted overhead
= (1,53,090 − 1,50,000) = ₹ 3,090(F)

(f) *Fixed Cost Variance* = Absorbed overhead − Actual overhead
= (1,53,090 − 1,56,000) = ₹ 2,910(A)

Check

(i) Fixed Cost Variance 2,910(A) = Expenditure Variance + Volume Variance
= 6,000 (A) + 3,090 (F)

(ii) Volume Variance 3,090(F) = Calender + Capacity + Efficiency variance
= 12,000 (F) + 8,100 (F) + 17,010 (A)

Problem 3.27 (*Overhead Variances*)

A company has a normal capacity of 120 machines, working 8 hours per day of 25 days in a month. The fixed overheads are budgeted at ₹ 1,44,000 per month. The standard time required to manufacture one unit of product is 4 hours.

In April, the company worked 24 days of 840 machine hours per day and produced 5,305 units of output. The actual fixed overheads were ₹ 1,42,000.

Compute :

(i) Efficiency variance
(ii) Capacity Variance
(iii) Calender variance
(iv) Expense variance
(v) Volume variance
(vi) Total fixed overhead variance.

(B Com Hons Delhi, C.A. Inter)

Solution

Basic Calculations :

	Budget	*Actual*
Fixed overhead (₹)	1,44,000	1,42,000
Working days	25	24
Working hours	120 machines × 8 hrs × 25 days = 24,000	840 hrs × 24 days = 20,160
Output in units	24,000 hrs ÷ 4 hrs = 6,000	5,305

Standard fixed overhead rate (per hour) = $\frac{₹\ 1,44,000}{24,000\ \text{hrs}}$ = ₹ 6

Computation of Variances

Total Fixed Overhead Variance = Recovered overhead – Actual overhead
= (5,305 units × 4 hrs × ₹ 6) – 1,42,000
= 1,27,320 – 1,42,000 = **₹ 14,680 (A)**

Expense Variance = Budgeted overhead – Actual overhead
= 1,44,000 – 1,42,000 = **₹ 2,000 (F)**

Volume Variance = Recovered overhead – Budgeted overhead
= (5,305 units × 4 hrs × ₹ 6) – 1,44,000
= ₹ 1,27,320 –1,44,000 = **₹ 16,680 (A)**

Efficiency Variance = Recovered overhead – Standard overhead
= (5,305 units × 4 hrs × ₹ 6) – (20,160 hrs × ₹ 6)
= 1,27,320 – 1,20,960 = **₹ 6,360 (F)**

Capacity Variance (Revised) = Standard overhead – Revised Budgeted overhead

$$= 1,20,960 - \left(1,44,000 \times \frac{24 \text{ days}}{25 \text{ days}}\right) = \textbf{₹ 17,280 (A)}$$

Calender Variance

$$= \left(\begin{matrix}\text{Actual working}\\ \text{days}\end{matrix} - \begin{matrix}\text{St. No. of}\\ \text{working days}\end{matrix}\right) \times \begin{matrix}\text{St. rate}\\ \text{per day}\end{matrix}$$

$$= (24 - 25) \times \frac{₹\ 1,44,000}{25 \text{ days}} = \textbf{₹ 5,760 (A)}$$

Check

(i) Total F.O. Variance = Expense Variance + Volume Variance
14,680 (A) = 2,000 (F) + 16,680 (A)

(ii) Volume Variance = Capacity Variance + Calender Variance + Efficiency Variance
16,680(A) = 17,280 (A) + 5,760 (A) + 6,360 (F)

Problem 3.28 (*Materials, Labour and Overhead Variances*)

(i) The following standard and actual data in respect of chemical *X* is made available to you from the records of Naulakha Chemicals Ltd.

Standard Data :

	₹	Total ₹
Materials		
450 kg of material *A* @ ₹ 20 per kg	9,000	
360 kg of material *B* @ ₹ 10 per kg	3,600	12,600
810		
Labour : @ per hour		
2,400 skilled hours @ ₹ 2		4,800
1,200 unskilled hours @ ₹ 1		1,200
90 kg Normal loss		—
720 kg	Total	18,600

Actual Data :

	₹	₹
Materials:		
450 kg of material *A* @ ₹ 19 per kg	8,550	
360 kg of material *B* @ ₹ 11 per kg	3,960	12,510
810		

Labour : @ per hour	
2,400 skilled hours @ ₹ 2.25	5,400
1,200 unskilled hours @ ₹ 1.25	1,500
50 kg Actual loss	
760 Total	19,410

You are required to compute :

(a) Material cost variance;
(b) Material price variance;
(c) Material yield variance;
(d) Labour cost variance;
(e) Labour rate variance;
(f) Labour yield variance.

(ii) From the following data, calculate:

(i) fixed overhead expenditure variance;
(ii) Fixed overhead volume variance;
(iii) Fixed overhead cost variance.

	Budgeted	Actual
Fixed overhead for July	₹ 10,000	₹ 10,200
Units of production in July	5,000	5,200
Standard time for one unit	4 hours	—
Actual hours worked	—	20,100 hrs.

(B.Com. Hons., Delhi)

Solution

(a) Material Cost Variance

= Std. cost of actual output – Actual cost

$$= \left(\frac{₹\ 12,600}{720\ kg} \times 760\ kg.\right) - 12,510 = ₹\ 790\ (A)$$

(b) Material Price Variance = $(SP - AP) \times AQ$

$A = (20 - 19) \times 450 = ₹\ 450\ (F)$

$B = (10 - 11) \times 360 = ₹\ 360\ (A)$

MPV ₹ 90 (F)

(c) Material Yield Variance = $(AY - SY) \times SOP$

$$= (760 - 720) \times \frac{12,600}{720} = ₹\ 700\ (F)$$

(d) Labour Cost Variance

(Std. cost of actual output – Actual cost)

$$\left(\frac{₹\ 4,800 + 1200}{720\ kg}\right) \times 760\ kg - (5400 + 1500) = ₹\ 566.67\ (A)$$

(e) Labour Rate Variance = $(SR - AR) \times AH$

Skilled = $(2 - 2.25) \times 2400$ = ₹ 600 (A)

Unskilled = $(1 - 1.25) \times 1200$ = ₹ 300 (A)

Total ₹ 900 (A)

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(f) **Labour Yield Variance** = $(AY - SY) \times SOR$

$(760 - 720) \times \frac{₹\ 6000}{720\ kg}$ = **₹ 333.33 (F)**

(i) **Fixed Overhead Expenditure Variance**

Budgeted overhead – Actual Overhead

10,000 – 10,200 = **₹ 200 (A)**

(ii) **Fixed Overhead Volume Variance**

Absorbed Overhead – Budgeted Overhead

(20800 × 050)* – 10,000 = **₹ 400 (F)**

(iii) **Fixed Overhead Cost Variance**

= Absorbed Overhead – Actual Overhead

= (20800 × 0.50) – 10,200) = **₹ 200 (F)**

*Note: Calculation of Absorbed Overhead

Std. hrs of actual output = 5,200 limits × 4 hrs. = 20,800 hrs

Std. rate per hr. = $\frac{₹\ 10,000}{5000\ units \times 4\ hrs.}$ = Re 0.50

Absorbed overhead = 20,800 hrs. × 0.50 = ₹ 10,400

Problem 3.29 (*Material, Labour and Overhead Variances*)

The standard cost card for product 'Simco' reveals :

	₹
Standard materials —	
2 kg of *A* @ ₹ 2 per kg	4.00
1 kg of *B* @ ₹ 6 per kg	6.00
Direct labour (3 hours @ ₹ 6 per hour)	18.00
Variable overhead (3 hours @ ₹ 4 per direct labour hour)	12.00
Total standard cost per unit	40.00

It is proposed to produce 10,000 units of 'Simco' in the month of March and budgeted costs on the information contained in the standard costs card are as follows:

	₹
Direct materials —	
A 20,000 kg @ ₹ 2 per kg	40,000
B 10,000 kg @ ₹ 6 per kg	60,000
Direct labour (30,000 hours @ ₹ 6 per hour)	1,80,000
Variable overhead (30,000 hours @ ₹ 4 per direct labour hr.)	1,20,000
Total	4,00,000

The actual results are :

Direct materials —	
A 19,000 kg @ ₹ 2.20 per kg	41,800
B 10,100 kg @ ₹ 5.60 per kg	56,560
Direct labour (28,500 hours @ ₹ 6.40 per hour)	1,82,400
Variable Overheads	1,04,000
	3,84,760

Actual production was 9,000 units.

From the above information, calculate the following variances:

(a) Material price and usage

(b) Labour wages rate and labour efficiency
(c) Variable overhead (i) Total variable overhead variance
(ii) Overhead expenditure variance.
(iii) Overhead efficiency variance

(B.Com. Hons., Delhi)

Solution

(a) **Material Variances**

(i) Material Price Variance = $(SP - AP) \times AQ$

$A = (2 - 2.20) \times 19,000$ = ₹ 3,800 (A)
$B = (6 - 5.60) \times 10,100$ = ₹ 4,040 (F)
MPV = **₹ 240 (F)**

(ii) Material Usage Variance = $(SQ - AQ) \times SP$

$A = (18,000 - 19,000) \times 2$ = ₹ 2,000 (A)
$B = (9,000 - 10,100) \times 6$ = ₹ 6,600 (A)
MUV = **₹ 8,600 (A)**

(iii) Material Cost Variance = *MPV* + *PUV*
= ₹ 240 (F) + ₹ 8,600 (A) = **₹ 8,360 (A)**

(b) **Labour Variances**

(i) Labour Rate Variance = $(SR - AR) \times AH$
= $(6 - 6.40) \times 28.500$ = **₹ 11,400 (A)**

(ii) Labour Efficiency Variance = $(SH - AH) \times SR$
= $(27,000 - 28,500) \times 6$ = **₹ 9,000 (A)**

(iii) Labour Cost Variance = *LRV* + *LEV*
= 11,400 (A) + 9,000 (A) = **₹ 20,400 (A)**

(c) **Variable Overhead Variances**

Total Variable Overhead Variance.
= (St. hrs. for actual production × St. overhead rate) – Actual variable overhead
= (27,000* × 4) – 1,04,000 = **₹ 4,000 (F)**
*9,000 units @ 3 hours per unit = 27,000 standard hours for actual production

***(i)* Overhead Expenditure Variance**
= (Standard overhead – Actual variable overhead)
= (28,500 × 4) – 1,04,000 = **₹ 10,000 (F)**

***(ii)* Overhead Efficiency Variance**
= (Standard hours for actual production – Actual hours) × Standard overhead rate
= (27,000 – 28,500) × 4 = **₹ 6,000 (A)**

Total Cost Variance = Total St. Cost – Total Actual Cost
= (9,000 units × ₹ 40) – ₹ 3,84,760 = **₹ 24,760 (A)**

UniBuddies

Problem 3.30 (Sales Variances)

SK Ltd. Furnishes the following information relating to budgeted sales and actual sales for April, 2017 :

	Product	Sales Quantity (Units)	Selling Price Per Unit ₹
Budgeted Sales:	A	1,200	15
	B	800	20
	C	2,000	40
Actual Sales:	A	880	18
	B	880	20
	C	2,640	38

Calculate the following variances:

(i) Sales Quantity Variance, (ii) Sales Mix Variance,
(iii) Sales Price Variance, and (iv) Total Sales Variance. (*B.Com Hons. Delhi*)

Solution

Basic calculations:

Product	Budget			Actual		
	Quantity units	Rate ₹	Amount ₹	Quantity units	Rate ₹	Amount ₹
A	1,200	15	18,000	880	18	15,840
B	800	20	16,000	880	20	17,600
C	2,000	40	80,000	2,640	38	1,00,320
Total	4,000		1,14,000	4,400		1,33,760

Calculation of standard sales :

Product	Actual Quantity (A)	Budgeted Price ₹ (B)	Standard Sales ₹ (A × B)
A	880	15	13,200
B	880	20	17,600
C	2,640	40	1,05,600
	4,400		1,36,400

Calculation of revised standard quantity :

$$\text{Revised Standard Quantity} = \frac{\text{Total AQ}}{\text{Total SQ}} \times \text{Standard Quantity}$$

$A = \frac{4,400}{4,000} \times 1,200 = 1,320$ $\quad B = \frac{4,400}{4,000} \times 800 = 880$ $\quad C = \frac{4,400}{4,000} \times 2,000 = 2,200$

Calculation of Variances :

1. **Sales Value Variance** = Actual Sales – Budgeted sales
= 1,33,760 – 114,000 = **₹19,760 (F)**

2. **Sales Price Variance** = (AP – SP) × AQ

A	= (18 – 15) × 880	= ₹ 2,640 (F)
B	= (20 – 20) × 880	= Nil.
C	= (38 – 40) × 2,640	= ₹ 5,280 (A)
		Total = **₹ 2,640 (A)**

Alternatively, Sales Price Variance = Actual sales – Standard sales
= 1,33,760 – 1,36,400 = ₹ 2,640 (A)

3. **Sales Volume Variance** = *(AQ – BQ) × SP*

A	= (880 – 1,200) × 15	= ₹ 4,800 (A)
B	= (880 – 800) × 20	= ₹ 1,600 (F)
C	= (2,640 – 2,000) × 40	= ₹ 25,600 (F)
		Total = **₹22,400 (F)**

Alternatively, Sales Volume Variance = Standard sales – Budgeted sales
= 1,36,400 – 1,14,000 = ₹ 22,400 (F)

4. **Sales Mix Variance** = *(AQ – RSQ) × SP*

A	= (880 – 1,320) × 15	= ₹ 6,600 (A)
B	= (880 – 880) × 20	= Nil.
C	= (2,640 – 2,200) × 40	= ₹ 17,600 (F)
		Total = **₹11,000 (F)**

5. **Sales Quantity Variance** = *(RSQ – BQ) × SP*

A	= (1,320 – 1,200) × 15	= ₹ 1,800 (F)
B	= (880 – 800) × 20	= ₹ 1,600 (F)
C	= (2,200 – 2,000) × 40	= ₹ 8,000 (F)
		Total = **₹11,400 (F)**

Check

(*i*) Sales Value Variance = Price Variance + Volume Variance
19,760 (F) = 2,640 (A) + 22,400 (F)

(*ii*) Sales Volume Variance = Mix Variance + Quantity variance
22,400 (F) = 11,000 (F) + 11,400 (F).

UniBuddies'

Problem 3.33 (*Sales Variances*)

The budgeted and actual sales for a period in respect of three products are given below:

Budgeted figures :

Product	*Quantity*	*Price* ₹	*Value* ₹
A	1,000	5	5,000
B	750	10	7,500
C	500	15	7,500
	2,250		20,000

Actuals :

Product	Quantity	Price ₹	Value ₹
A	1,200	6	7,200
B	700	9	6,300
C	600	14	8,400
	2,500		21,900

Calculate sales variances. *(C.A. Inter)*

Solution

1. **Sales Value Variance** = Actual sales – Budgeted sales
   = 21,900 – 20,000 = **₹1,900 (F)**

2. **Sales Price Variance** = $(AP - SP) \times AQ$
   $A = (6 - 5) \times 1,200$ = ₹ 1,200 (F)
   $B = (9 - 10) \times 700$ = ₹ 700 (A)
   $C = (14 - 15) \times 600$ = ₹ 600 (A)
   ₹ 100 (A)

3. **Sales Volume Variance** = $(AQ - BQ) \times SP$
   $A = (1,200 - 1,000) \times 5$ = ₹ 1,000 (F)
   $B = (700 - 750) \times 10$ = ₹ 500 (A)
   $C = (600 - 500) \times 15$ = ₹ 1,500 (F)
   ₹2,000 (F)

4. **Sales Mix Variance** = $(AQ - RSQ) \times SP$

$$A = \left(1,200 - \frac{2,500}{2,250} \times 1,000\right) \times 5 = ₹\ 444\ (A)$$

$$B = \left(700 - \frac{2,500}{2,250} \times 750\right) \times 10 = ₹\ 1,333\ (F)$$

$$C = \left(600 - \frac{2,500}{2,250} \times 500\right) \times 15 = ₹\ 667\ (A)$$

₹ 222 (A)

5. **Sales Quantity Variance** = $(RSQ - BQ) \times SP$

$$A = \left(\frac{2,500}{2,250} \times 1,000 - 1,000\right) \times 5 = ₹\ 556\ (F)$$

$$B = \left(\frac{2,500}{2,250} \times 750 - 750\right) \times 10 = ₹\ 833\ (F)$$

$$C = \left(\frac{2,500}{2,250} \times 500 - 500\right) \times 15 = ₹\ 833\ (F)$$

₹ 2,222 (F)

Check

Value Variance = Price Variance + Mix Variance + Quantity Variance

1,900(F) = 100 (A) + 222 (A) + 2,222 (F)

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Problem 3.34 (*Control Ratios*)

Insilco. Ltd. produces two commodities, Good and Better, in one of its department. Each unit takes 5 hours and 10 hours as production time respectively. 1,000 units of Good and 600 units of Better were produced during March. Actual man-hours spent in this production were 10,000. Yearly budgeted hours are 96,000.

Compute the various control ratios. *(C.S. Inter)*

Solution

Monthly budgeted hours = 9,600 hrs ÷ 12 months = 8,000 hours

Standard hours for actual output = (1,000 × 5) + (600 × 10) = 11,000 hours

Actual hours worked = 10,000 hours

(*a*) **Efficiency Ratio** $= \frac{\text{St. hrs. for acutal output}}{\text{Actual hours}} \times 100 = \frac{11,000}{10,000} \times 100 =$ **110%**

(*b*) **Activity Ratio** $= \frac{\text{St. hrs. for acutal output}}{\text{Budgeted hours}} \times 100 = \frac{11,000}{8,000} \times 100 =$ **137.50%**

(*c*) **Capacity Ratio** $= \frac{\text{Actual hours}}{\text{Budgeted hours}} \times 100 = \frac{10,000}{8,000} \times 100 =$ **125%**

Check

Activity Ratio = Capacity Ratio × Efficiency Ratio

137.50% = 125% × 110%

Problem 3.35 (*Control Ratios*)

If activity ratio of a company is 104% and its capacity ratio is 96%, find out its efficiency ratio. *(C.A. Inter)*

Solution

Activity ratio = Capacity ratio × Efficiency ratio

$\therefore$ **Efficiency ratio** $= \frac{\text{Activity ratio}}{\text{Capacity ratio}} = \frac{104}{96} \times 100 =$ **108.33%.**

Problem 3.36 (*Control Ratios*)

Calculate (*a*) Efficiency ratio, (*b*) Activity ratio, and (*c*) Capacity ratio from the following figures :

Budgeted production	88 units
Standard hours per unit	10
Actual production	75 units
Actual working hours	600

(B.Com. Hons., Delhi)

UniBuddies'

Solution

St. hours for actual output = 75 units × 10 hrs. = 750

Budgeted hours = 88 units × 10 hrs. = 880

(a) **Efficiency Ratio** $= \frac{\text{St. hours for actual output}}{\text{Actual hours}} \times 100$

$= \frac{750}{600} \times 100 = 125\%$

(b) **Activity Ratio** $= \frac{\text{St. hours for actual output}}{\text{Budgeted hours}} \times 100$

$= \frac{750}{880} \times 100 = 85.23\%$

(c) **Capacity Ratio** $= \frac{\text{Actual hours}}{\text{Budgeted hours}} \times 100$

$= \frac{600}{880} \times 100 = 68.18\%$

Check

Activity Ratio = Efficiency ratio × Capacity ratio

85.23% = 125% × 68.18%

KEY TERMS

Standard Cost: It is a pre-determined cost which tells what each product or service should cost under given circumstances.

Standard Costing is a specialized technique to control the cost in which the standard cost of each product is compared with the actual costs, to determine the efficiency of the operations so that any remedial action may be taken immediately.

Variance: This is the difference between the standard cost and actual cost.

Variance Analysis is the process of analysing variances by sub-dividing the total variance in such a way that management can identify reasons for off standard performance so that corrective action can be taken.

Material Cost Variance: This is the difference between the standard cost of direct materials specified for the output achieved and the actual cost of direct materials used

Labour Cost Variance: This is the difference between the standard direct labour cost specified for the activity achieved and the actual direct labour cost incurred.

Overhead Cost Variance: It is the difference between absorbed overhead and actual overhead.

Sales Value Variance: It is the difference between budgeted value of sales and actual value of sales.

Control Ratios: Certain control ratios are commonly used by management for use in controlling operations. Three important control ratios are Efficiency Ratio, Activity Ratio and Capacity Ratio.

EXAMINATION QUESTIONS

Objective Type Questions

I. True or False Statements

1. Standard costing is a technique of cost control and not of cost reduction.
2. Labour mix variance is a sub-variance of labour rate variance.
3. Idle time variance is always unfavourable.
4. Overhead volume variance is always favourable.
5. Overhead expenditure variance plus overhead efficiency variance is equal to overhead budget variance for variable overhead.
6. Calendar variance arises only in case of fixed overheads.
7. Gang composition variance is a sub-variance of labour time variance.
8. When material cost variance is ₹ 1,000 (Adverse) and material quantity variance is ₹ 1,800 (Favourable), then material price variance will be ₹ 800 (Adverse).
9. Consumption of high value materials in larger proportion results is adverse material mix variance.
10. Revision variance is the difference between actual cost and revised standard cost.

[**Ans.** 1. False, 2. False 3. True, 4. False, 5. False, 6. True, 7. True, 8. False, 9. True, 10. False]

Essay Type Questions

1. Define and explain the concept of 'standard cost' and 'standard costing'. *(B.Com. Hons. Delhi)*
2. Explain briefly the significance of standard costing as a technique of cost control. *(B.Com. Hons. Delhi)*
3. Distinguish between standard cost and estimated cost. *(B.Com. Hons. Delhi)*
4. Define standard costing. In what type of industries is standard costing employed? *(B.Com., Calicut)*
5. Point out the differences between historical costing and standard costing. *(B.Com., Kerala)*
6. Discuss the advantages and limitations of standard costing. *(B.Com., Kerala)*
7. Outline the primary objects of standard costing. Describe briefly its uses under each of the following heads:
   (*a*) As a measuring rod of performance, (*b*) As a basis of inventory valuation,
   (*c*) As an aid in preparing earnings budget, (*d*) As a guide in fixing selling prices.
   (B.Com. Hons., Delhi)
8. Distinguish between standard costing and budgetary control. *(B.Com. Hons., Delhi)*
9. What is 'standard costing'? Bring out clearly the relationship between standard costing and budgetary control. *(B.Com. Hons.Delhi)*
10. Standard costing and budgetary control are inter-related but not independent. *(B.Com. Hons. Delhi)*
11. "Calculation of variances in standard costing is not an end in itself, but a means to an end." Discuss. *(I.C.W.A. Inter)*
12. What do you understand by the following
    (*a*) Efficiency ratio (*b*) Activity ratio (*c*) Capacity ratio *(B.Com. Hons., Delhi)*

Practical Questions

1. The following particulars are regarding the standard and actual production of product *X*.

Standard quantity of material per unit	5 kg.
Standard price per kg.	₹ 5

Actual number of units produced	400
Actual quantity of materials used	2,200 kg.
Price of materials	₹ 4.80 per kg.

Calculate (*i*) Material price variance (*ii*) Material usage variance *(B.Com., Madurai)*

[Ans. (*i*) ₹ 440 (F) (*ii*) ₹ 1,000 (A)]

2. Given that the cost standards for material consumption are 40 kg. @ ₹ 10 per kg, compute the variance when actuals are:
   (*a*) 48 kg. at ₹ 10 per kg. (*b*) 40 kg. at ₹ 12 per kg.
   (*c*) 48 kg. at ₹ 12 per kg. (*d*) 36 kg. for a total cost of ₹ 360.

(C.A. Inter)

[Ans. MPV (*a*) Nil, (*b*) ₹ 80 (A), (*c*) ₹ 96 (A), (*d*) Nil,; MUV (*a*) ₹ 80 (A), (*b*) Nil, (*c*) ₹ 80 (A), (*d*) ₹ 40 (F)]

3. In a factory, standard estimates for material for the manufacture of 1,000 units of product Z is 400 kg. at ₹ 2.50 per kg. When 2,000 units of product Z are produced it is found that 825 kg of materials are consumed at ₹ 2.70 per kg. Calculate material variances. *(B.Com, Calcutta)*

[Ans. MCV ₹ 227.50(A), MPV ₹ 165(A) MUV ₹ 62.50 (A)]

4. Calculate the mix variance

	Material	*Quantity (kg.)*	*Rate ₹*
Standard	*A*	10	2
	B	15	3
Actual	*A*	8	2.50
	B	17	2.50

(B.Com., Calicut)

[Ans. Mix Variance ₹ 2 (A)]

5. The standard cost card for one unit of product shows the following costs for material and labour.
   Material 4 pieces @ ₹ 5.00
   Labour 10 hours @ ₹ 1.50

5,700 units of the product were manufactured during the month of March, with the following material and labour costs:
   Material — 23,000 pieces @ ₹ 4.95
   Labour — 56,800 hours @ ₹ 1.52

Calculate appropriate material and labour variances. *(B.Com. Hons., Delhi)*

[Ans. (*i*) MCV ₹ 150 (F); MPV ₹ 1,150 (F); MQV ₹ 1,000 (A)
(*ii*) LCV ₹ 836 (A); LRV ₹ 1,136 (A); LEV ₹ 300 (F)]

6. For a unit of product *A*, the standard data is given below:

Material . . . 5 kg. @ ₹ 40 per kg.	₹ 200
Labour . . . 40 hrs. @ ₹ 1.00 per hour	₹ 40
	₹ 240

Actual data

Actual production 100 units	
Materials: 490 kg. @ ₹ 42 each	₹ 20,580
Labour: 3,960 hrs. @ ₹ 1.10 per hour	4,356
	24,936

Calculate:

1. Material cost variance
2. Material price variance
3. Material usage variance
4. Labour cost variance
5. Labour rate variance
6. Labour efficiency variance

(*Adapted*)

[**Ans.** 1. ₹ 580 (A). 2. ₹ 980 (A), 3. ₹ 400 (F), 4. ₹ 356 (A), 5. ₹ 396 (A), 6 ₹ 40 (F)]

7. The standard cost on 'material' and 'labour' for the making of a unit of a certain product are estimated as under:

Material 80 kg. at ₹ 1.50 per kg.

Labour 18 hrs. at ₹ 1.25 per hr.

On completion of the production of a unit, it was found that 75 kg. of material costing ₹ 1.75 per kg. has been consumed and that the time taken was 16 hours, the wage rate being 1.50 per hour. Your are required to calculate material and labour variances.(*B.Com., Hons., Delhi*)

[**Ans.** *MPV*-₹ 18.75 (A), *MUV* ₹ 7.50 (F), *LRV* ₹ 4 (A), *LEV* ₹ 2.50 (F)]

8. From the following data, calculate material mix variance.

Material	*Standard quantity*	*Actual quantity*	*Price per unit*
X	50	45	14
Y	40	35	12
Z	30	40	11

Due to shortage of *X*, it was decided to reduce its consumption by 10 and increase the consumption of *Y* and *Z* by 6 and 4 respectively. (*B.Com. Calcutta*)

[**Ans.** *MMV* ₹ 4 (A)]

(**Hint.** Adjust standard qunatities)

9. From the following calculate:

(*a*) Price variance, (*b*) Usage variance, (*c*) Mix variance, and (*d*) Revised usage variance:

Material	*Standard*			*Actual*		
	Qty.	*Rate*	*Amt.*	*Qty.*	*Rate*	*Amt.*
A	10	2	20	5	3	15
B	20	3	60	10	6	60
C	20	6	120	15	5	75

(*B.Com., Madurai*)

[**Ans.** (*a*) ₹ 20 (A), (*b*) 70 (F), (*c*) ₹ 10 (A), (*d*) ₹ 80 (F)]

10. From the following compute : (*i*) Material price variance (*ii*) Material quantity variance (*iii*) Material mix variance, and (*iv*) Material cost variance.

Material	*Standard*		*Actual*	
	Quantity Kg.	*Unit price ₹*	*Quantity Kg.*	*Unit Price ₹*
A	10	2	5	3
B	20	3	10	6
C	20	6	5	5
	50		30	

[**Ans.** (*i*) ₹ 20 (A), (*ii*) ₹ 70 (F), (*iii*) ₹ 10 (A), (*iv*) ₹ 50 (F)]
(M.Com. Bharathidasan)

11. Philips Company manufactures Product 'P' by mixing three raw materials. For every 100 kg. of P, 125 kg. of raw materials are used. In April there was an output of 5,600 kg of P. The standard and actual particulars for April are as follows:

Raw Material	*Standard*		*Actual*	
	Mix	*Price per Kg.* ₹	*Mix*	*Price per Kg.* ₹
I	50%	40	60%	42
II	30%	20	20%	16
III	20%	10	20%	12

Calculate all material variances assuming actual quantity of materials consumed was 7,000 kg.
(B.Com. Hons. Delhi)

[**Ans.** *MCV* ₹ 19,600 (A), *MPV* ₹ 5,600 (A), *MUV* ₹ 14,000 (A) *MMV* ₹ 14,000 (A), *MYV* Nil]

12. From the following data, calculate material variances.

Material	*St. Qty.*	*St. Rate*	*Actual Qty.*	*Actual Rate*
X	8,000 kg.	₹ 1.05	7,500 kg.	₹ 1.20
Y	3,000 kg.	₹ 2.15	3,300 kg.	₹ 2.30
Z	2,000 kg.	₹ 3.30	2,400 kg.	₹ 3.50

Also write a note on the relationship of various variances that you compute.
(I.C.W.A., Inter)

[**Ans.** *MCV* ₹ 3,540 (A); *MPV* ₹ 2,100 (A); *MQV* ₹ 1,440 (A); *MMV* ₹ 1,110 (A); *MRQV* ₹ 330 (A)]

13. Birla & Co. Ltd. manufactures product *P* and uses a standard cost system. Standard product and cost specification for 1,000 kg. of product are as follows:

Material	*Qty. in kg.*	*Price* ₹	*Cost* ₹
A	800	2.50	2,000
B	200	4.00	800
C	200	1.00	200
Input	1,200		3,000
Output	1,000		

Material records indicate:

	Consumption in January
A	1,57,000 kg. @ ₹ 2.40
B	38,000 kg @ ₹ 4.20
C	36,000 kg @ ₹ 1.10

Actual finished production for the month of January is 2,00,000 kg. Calculate material variances.
(B Com Hons Delhi I.C.W.A. Inter)

[**Ans.** *MPV*-₹ 4,500 (F), *MUV* ₹ 19,500 (F), *MMV* ₹ 3,000 (A), *MYV*-₹ 22,500 (F), *MCV* ₹ 24,000 (F)]

14. Pieco Ltd. is producing a 'standard mix' by using 60 kg. of material *X* and 40 kg. of material *Y*. The standard loss of production is 30%. The standard price of *X* is ₹ 5 per kg. and that of *Y* ₹ 10 per kg.

The actual mixture and yield were as follows:

X 80 kg. @ ₹ 4.50 per kg.

Y 70 kg. @ ₹ 8 per kg.

Actual yield is 115 kg.

Calculate material variances. *(C.S. Inter)*

[Ans. MCV ₹ 230 (F); MPV ₹ 180 (F); MQV ₹ 50 (F); MMV ₹ 50 (A); MYV ₹ 100 (F)]

15. Following are the particulars in respect of a product where two types of materials *A* and *B* are used:

Material input	*Standard*		*Actual*	
	Tons	*Rate* ₹	*Tons*	*Rate* ₹
A	120	10.00	140	9.50
B	80	7.50	60	9.00
	200		200	
Less: Loss	20		18	
Net production	180		182	

You are required to calculate:

(*a*) Material Price Variance (*b*) Material Mix Variance,

(*c*) Material Yield Variance (*d*) Material Usage Variance

(M. Com., Madras)

[Ans. (*a*) ₹ 20 (A); (*b*) ₹ 50 (A); (C) ₹ 20 (F); (*d*) ₹ 30 (A)]

16. The standard cost of a certain chemical mixture '*AB*' is:

40% material *A* at ₹ 400 per kg.

60% material *B* at ₹ 600 per kg.

A standard loss of 10% is anticipated in production :

The following particulars are available for the month of December.

180 kg. of material *A* has been used at ₹ 360 per kg.

220 kg. of material *B* has been used at ₹ 680 per kg.

The actual production of '*AB*' is 369 kg.

Calculate:

(*a*) Material Cost Variance (*b*) Material Price Variance

(*c*) Material Usage Variance (d) Material Mix Variance

(*e*) Material Yield Variance

(B Com Hons Delhi, I.C.W.A. Inter]

[Ans. (*a*) *MCV* ₹ 1,200 (A), (*b*) *MPV* ₹ 10,400 (A), (*c*) *MUV* ₹ 9,200 (F), (*d*) *MMV* ₹ 4000 (F); *MYV* ₹ 5200 (F)].

17. The standard cost of a certain chemical mixture is:

35% material *A* at ₹ 25 per kg.

65% material *B* at ₹ 36 per kg.

A standard loss of 5% is expected in production. During a period there is used:
125 kg. of material *A* at ₹ 27 per kg., and
275 kg. of material *B* at ₹ 34 per kg.
The actual output was 365 kg.
Calculate:
(*a*) Material Cost Variance (*b*) Material Price Variance
(*c*) Material Mix Variance (*d*) Material Yield Variance

(B.Com. Hons., Delhi;]

[Ans. (*a*) ₹ 372.97 (A), (*b*) ₹ 300 (F), (*c*) ₹ 165 (A), (*d*) ₹ 507.97 (A)]

18. The standard mix of product A 2 is as follows :

Kgs	*Material*	*Price per kg.* (₹)
45	*X*	6.00
25	*Y*	4.50
30	*Z*	9.50

The standard loss in production is 10% of input. There is no scrap value. Actual production for a month was 7,425 kgs. of A2 from 80 mixes. Actual purchases and consumption of material during the month were :

Kg	*Material*	*Price per kg.* (₹)
4,200	*X*	6.50
1,700	*Y*	4.25
2,600	*Z*	9.75

You are required to calculate the following variances for presentation to the management:
(*i*) Material cost variance (*ii*) Material price variance
(*iii*) Material mix variance (*iv*) Material yield variance.
(*v*) Material usage variance

(C.S. Inter)

[Ans. (*i*) ₹ 4806.25 (A), (*ii*) ₹ 2,325 (A); (*iii*) ₹ 812.50 (A), (*iv*) ₹ 1668.75 (A) (*v*) ₹ 2481.25 (A)]

19. Modern Tiles Ltd. makes plastic tiles of standard size of 6" × 6" × 1/8". From the following information, you are required to calculate direct materials:
(*i*) the cost variance in total.
(*ii*) the cost variance sub-divided into (*a*) price; and (*b*) usage.
(*iii*) the usage variance analysed into (*a*) mix; and (*b*) yield.

A standard mix of the compound required to produce an output of 20,000 square feet of tiles 1/8" thick is as follows:

Direct Materials	*Quantity (Kgs.)*	*Price Per Kg.* (₹)
A	600	0.90
B	400	0.65
C	500	0.40

During December, eight mixes were processed and actual materials consumed were:

Direct Materials	*Quantity (Kgs.)*	*Price Per Kg.* (₹)
A	5,000	0.85
B	2,900	0.60
C	4,400	0.45

Actual production for December was 6,20,000 tiles.

(B. Com Hons Delhi, C.S. Inter)

[Ans. *MCV* ₹ 220 (A), *MPV* ₹ 175 (F), *MMV* ₹ 55 (F); *MYV* ₹ 450 (A)]

[Hint. Area covered per tile = 6" × 6" = 36"
Area per sq. ft = 12" × 12" = 144"
No. of tiles required per sq. ft = 144 ÷ 36 = 4
No. of tiles required for 20,000 sq. ft = 20,000 × 4 = 80,000,
St. output from 8 mixes = 80,000 × 8 = 6,40,000 tiles.
Actual output = 6,20,000 tiles.]

20. The standard material cost of manufacturing a product shows the following standards:

Materials	*Quantity*	*Standard Price per kg.*	*Amount*
		₹	₹
A	40 kg.	75	3,000
B	10 kg.	50	500
C	50 kg.	20	1,000
	Material cost per unit (Total)		4,500

The standard material input mix is 100 kg. and the standard output of the finished product is 90 kg. The actual results for period are :

Materials used :

A	2,40,000 kg.	@ ₹ 80 per kg.
B	40,000 kg.	@ ₹ 52 per kg.
C	2,20,000 kg.	@ ₹ 21 per kg.

Actual output of the finished product is 4,20,000 kg.

You are required to calculate the material price, mix and yield variances. (*I.C.W.A. Inter*)

[Ans. *MCV* ₹ 49,00,000 (A), *MPV* ₹ 15,00,000 (A), *MUV* ₹ 34,00,000 (A), *MMV* ₹ 19,00,000 (A), *MYV* ₹ 15,00,000 (A)]

21. The standard cost of a product is: 10 hours per unit at ₹ 5 per hour

The actual data is:

Production 1,000 units

Hours taken:

Production	10,400 hours
Idle time	400 hours
Total time	10,800 hours

Payments made ₹ 56,160 at ₹ 5.20 per hour. Calculate:

(*a*) Labour cost variance (*b*) Labour efficiency variance

(*c*) Labour rate variance (*d*) Idle time variance. (*B.Com., Meerut*)

[Ans. (*a*) ₹ 6,160 (A), (*b*) ₹ 4,000 (A), (*c*) ₹ 2,160 (A), (*d*) ₹ 2,000 (A)]

22. Find out different Labour Variances.

	Standard	*Actual*
Output :	1,000 units	1,200 units
Rate of payment :	₹ 6 per unit	Wages paid with bonus : ₹ 8,000
Time taken :	50 hours	40 hours.

[Ans. *LCV* ₹ 800 (A), *LRV* ₹ 3,200 (A); *LEV* ₹ 2,400 (F)]

[Hint. St. rate per hour ₹ 120, Actual rate per hour ₹ 200]

23. A job is scheduled to be completed in 30 weeks with a labour employment of 100 skilled operatives, 40 semi-skilled operatives and 60 unskilled operatives. The standard weekly wage of each type of operatives are – skilled ₹ 60, semi-skilled ₹ 36 and unskilled ₹ 24. The work is actually completed in 32 weeks with a labour force of 80 skilled, 50 semi-skilled and 70 unskilled operatives and the actual weekly wage rates average ₹ 65 for skilled, ₹ 40 for semi-skilled and ₹ 20 for unskilled labour. Analyse the variance in the labour cost due to various reasons. *(I.C.W.A, Inter)*

[Ans. *LCV* ₹ 8,800 (A), *LRV* ₹ 10,240 (A), *LEV* ₹ 1,440 (F), *LMV* ₹ 19,200 (F), *LREV* ₹ 17,760 (A)]

24. A gang of workers usually consists of 10 men, 5 women and 5 boys paid at standard hourly rates of ₹ 1.25, ₹ 0.80 and ₹ 0.70 respectively. In a normal working week of 40 hours, the gang is expected to produce 1,000 units of output.

In a certain week, the gang consisted of 13 men, 4 women and 3 boys; actual hourly rates being ₹ 1.20 ₹ 0.85 and ₹ 0.65 respectively. Two hours were lost due to abnormal idle time and 960 units of output were produced.

Calculate appropriate labour variances. *(I.C.W.A. Inter)*

[Ans. *LCV* ₹ 70 (A), *LRV* ₹ 24 (F), *LEV* ₹ 94 (A), *LMV* ₹ 58.90 (A), *LITV* ₹ 43.10 (A), *LREV* ₹ 8 (F)]

25. The standard labour composition and the actual labour composition engaged during the month are given below :

	Skilled	*Semi-skilled*	*Unskilled*
(*a*) Standard number of workers in a group	30	10	10
(*b*) Standard wage rate (₹ per hour)	5	3	2
(*c*) Actual number of workers employed during the month in the group	24	15	12
(*d*) Actual wage rate per hour (₹)	6	2.5	2

During the month of 200 working hours, the group produced 9,600 standard hours of work.

Required : Calculations showing Wage rate variance, Labour (revised) efficiency variance, Labour mix variance and Total labour cost variance. *(I.C.W.A., Inter)*

[Ans. Wage rate variance ₹ 3,300 (A); Labour efficiency (revised) variance ₹ 2,400 (A); Labour mix variance ₹ 3,000 (F); Total labour cost variance ₹ 2,700 (A)]

26. From the following data, prepare unit cost statement showing prime cost of products A and B together with analysis of variances :

Materials		*Product A*	*Product B*
	Standard	600 kg. @ ₹ 5.00	90 kg. @ ₹ 3.00
	Actual	580 kg. @ ₹ 5.50	100 kg. @ ₹ 2.80
Labour :	Standard	80 hrs. @ ₹ 2.00	16 hrs. @ ₹ 2.80
	Actual	92 hrs. @ ₹ 1.75	14 hrs. @ ₹ 2.60

(I.C.W.A., Inter)

[Ans. ***Product A*** : Standard total cost ₹ 3,160; Product B : ₹ 314.80; Actual total Cost ₹ 3,351; product B : ₹ 316.40; Total cost variance : A ₹ 191 (A) B ₹ 1.60 (A)

Material : A : *MPV* ₹ 290 (A) *MUV* ₹ 100 (F) *MCV* ₹ 190 (A); B : *MPV* ₹ 20 (F) *MUV* ₹ 30 (A) *MCV* ₹ 10 (A),

Labour : A : *LRV* ₹ 23 (F) *LEV* ₹ 24 (A) *LCV* ₹ 1,00 (A); B : *LRV* ₹ 2.80 (F) *LEV* ₹ 5.60 (F) *LCV* ₹ 8.40 (F)]

27. The following was the composition of the gang of workers in a factory during a particular month, in one of the production departments. The standard composition of workers and wage rate per hour were as below :

Skilled : Two workers at a standard rate of ₹ 20 per hour each
Semi-skilled: Four workers at a standard rate of ₹ 12 per hour each
Unskilled : Four workers at a standard rate of ₹ 8 per hour each

The standard output of the gang was four units per hour of the product. During the month in question, however, the actual composition of the gang and hourly rates paid were as under :

Type of worker	*No. of workers*	*Wage rate paid per worker per hour engaged*
Skilled	2	20
Semi-skilled	3	14
Unskilled	5	10

The gang was engaged for 200 hours during the month, which included 12 hours when no production was possible, due to machine breakdown. 810 units of the product were recorded as output of the gang during the month.

You are required : (a) to compute the standard unit labour cost of the product; (b) to compute the total variance in labour cost during the month; and (c) analyse the variances in (b) above in sub-variances and reconcile. *(I.C.W.A., Inter)*

[**Ans.** *LCV* ₹ 2,100 (A), *LRV* ₹ 3,200 (A), *LEV* ₹ 1,100 (F), *ITV* ₹ 1,440 (A), *LYV* ₹ 1,740 (F)]

28. The following standards have been set to manufacture a product:

	₹
Direct materials :	
2 units of *A* at ₹ 4 per unit	8.00
3 units of *B* at ₹ 3 per unit	9.00
15 units of *C* at ₹ 1 per unit	15.00
	32.00
Direct labour 3 hrs. @ ₹ 8 per hour	24.00
Total Standard Prime Cost	56.00

The company manufactured and sold 6,000 units of the product during the year. Direct material costs were as follows:

12,500 units of *A* at ₹ 4.40 per unit.
18,000 units of *B* at ₹ 2.80 per unit.
88,500 units of *C* at ₹ 1.20 per unit.

The Company worked 17,500 direct labour hours during the year. For 2,500 of these hours the company paid at ₹ 12 per hour while for the remaining the wages were paid at the standard rate. Calculate Materials Price and Usage Variances and Labour Rate and Efficiency Variances.

(B. Com Hons Delhi)

[**Ans.** MPV ₹ 19,100 (A), MUV ₹ 500 (A), LRV ₹ 10,000 (A), LEV ₹ 4,000 (F)]

29. The records of Conwest Engineering Corporation indicate the following for the month of April.

Standards		*Unit cost*
Direct material	4 gallons @ ₹ 1.20	₹ 4.80
Direct labour	3 hours @ ₹ 1.80	₹ 5.40
Factory overhead	₹ 0.60 per labour hour	₹ 1.80
	Total manufacturing cost	₹ 12.00

Month of April Activity

(i) Production during the month of April, has been 6,500 units with no beginning or ending work-in-progress inventories.

(ii) *Materials:*

Purchased	32,000 gallons @ ₹ 1.18 per gallon
Used in production	25,600 gallons

(iii) *Labour:*

Hours worked	20,000
Average hourly wage rate	₹ 1.75

(iv) Factory overhead :

Total overhead cost incurred	₹ 12,500

Calculate material variances, labour variances and only total variance for factory overhead.

(B.Com., Hons. Delhi)

[Ans. MCV ₹ 992 (F), MPV ₹ 512 (F), MQV ₹ 480 (F), LCV ₹ 100 (F), LRV ₹ 1,000 (F), LEV ₹ 900 (A), OCV ₹ 800 (A)]

30. From the following calculate:

(a) Variable Overhead Cost Variance

(b) Variable Overhead Efficiency Variance

	Budgeted	*Actual*
Overhead ₹	3,00,000	3,20,000
Output (units)	30,000	26,000
Working hours	75,000	60,000

(M.Com., Bharathidasan)

[Ans. (a) ₹ 60,000 (A); (b) ₹ 20,000 (F)]

31. The following information is available from the records of a company.

	Budget	*Actual*
Fixed overhead for June	₹ 10,000	12,000
Production in June (units)	2,000	2,100
Standard time per unit (hrs.)	10	—
Actual hours worked in June (hrs.)	—	22,000

Compute : (i) Fixed overhead cost variance (ii) Expenditure variance
(iii) Volume variance (iv) Capacity variance
(v) Efficiency variance

(B.Com. Hons. Delhi, Adapted)

[Ans. (i) ₹ 1,500 (A), (ii) ₹ 2,000 (A), (iii) ₹ 500 (F), (iv) ₹ 1,000 (F), (v) ₹ 500 (A)]

32. From the following prepare variance analysis of a particular department for a month:

	Actual ₹
Variable Overhead items:	
Material handing	8,325
Idle Time	850
Re-work	825
Overtime premium	250
Supplies	4,000
	14,250
Fixed Overhead Items:	
Supervision	1,700
Depreciation of plant	2,000

Depreciation of equipment	5,000
Rates	1,150
Insurance	350
	10,200

Normal capacity 10,000 standard hours, budgeted rate ₹ 1.70 per standard hour for variable overhead and ₹ 1 per standard hour for fixed overhead. Actual level is 8,000 standard hours. *(I.C.W.A. Inter)*

[**Ans.** *VO* Cost Variance ₹ 650 (A), *FO* Cost Variance ₹ 2,200 (A), *FO* Expenditure Variance ₹ 200 (A), *FO* Volume Variance ₹ 2,000 (A)]

33. From the following prepare overhead variance analysis of a particular department for a month. Actual factory overhead ₹ 14,250.
Budgeted production capacity 10,000 standard hours, budgeted overhead absorption rate ₹ 1.70 per standard hour for factory overhead. Actual production level 8,000 standard hours. *(B.Com. Hons Delhi)*

[**Ans.** *OCV* ₹ 650 (A), *OBV* ₹ 2,750 (F), *OVV* ₹ 3,400 (A)]

34. Determine the budget and capacity variances from the following data :

Estimated Factory Overhead	₹ 25,000
Estimated Direct Labour Hours	5,000
Actual Overhead Expenses	₹ 26,500
Applied Overhead Expenses	₹ 22,500

(I.C.W.A. Inter)

[**Ans.** Budget variance ₹ 1,500 (A), Capacity variance ₹ 2,500 (A)]

[**Hint**—St. overhead rate 25,000 ÷ 5,000 = ₹ 5 per hour; Actual hours 22,500 ÷ 5 = 4,500; Capacity Variance = (4,500 – 5,000) × ₹ 5 = 2,500 (A)]

35. *DCW* Ltd. produces a single product from a single material. It furnishes the following information:

	Budget	*Actual*
Output units	8,000	6,000
Materials:		
Total quantity	kg. 16,000	13,000
Total amount	₹ 32,000	27,300
Labour:		
Total hours	2,400	2,000
Total amount	₹ 3,000	3,000
Variable Overhead Expenses:		
Total hours	2,400	2,000
Total amount	₹ 2,400	2,200

You are required to compute the following variances:

(*a*) Material Price Variance (*b*) Material Usage Variance
(*c*) Labour Rate Variance (*d*) Labour Efficiency Variance
(*e*) Overhead Efficiency Variance (*f*) Overhead Budget Variance
(*g*) Overhead Cost Variance *(C.A. Inter)*

(**Ans.** (*a*) ₹ 1,300 (A), (*b*) ₹ 2,000 (A), (*c*) ₹ 500 (A), (*d*) ₹ 250 (A), (*e*) ₹ 200 (A), (*f*) ₹ 200 (A), (*g*) ₹ 400 (A)]

36. From the following data, calculate overhead variances:

	Dept. X	*Dept. Y*
Hours, when working at normal capacity	4,000	2,000
Overhead hourly rate	₹ 0.50	₹ 2

Hours allowed for actual production		4,000	1,600
Actual details — Hours		4,150	1,550
— Overhead		₹ 2,020	3,750

(*B. Com Hons Delhi, Adopted, I.C.W.A. Inter*)

[**Ans.** Dept. *X* — *OCV* ₹ 20 (A), *OBV* ₹ 20 (A) *OVV* – nil Dept. *Y* — *OCV* ₹ 550 (A) *OBV* ₹ 250 (F), *OVV* ₹ 800 (A)]

37. The following information is available from the cost records of a company for December, 2017 :

	₹
Materials purchased 20,000 pieces	88,000
Materials consumed 19,000 pieces	
Actual wages paid for 4,950 hour	24,750
Fixed factory overheads budgeted	40,000
Fixed factory overhead incurred	44,000
Units produced—1800	

Standard rates and prices are :

Direct material rate—₹ 4 per piece
Standard input—10 pieces per unit
Direct labour rate—₹ 4 per hour
Standard hours required to produce a unit—2.5 hours
Overheads—₹ 8 per labour hour.

Compute the following variances

(*a*) Material price and usage;
(*b*) Labour rate and efficiency;
(*c*) Fixed overheads expenditure variance;
(*d*) Fixed overheads volume variance.

(*B.Com. Hons. Delhi*)

[**Ans.** (*a*) MPV ₹ 7,600 (A); MUV ₹ 4,000 (A); (*b*) LRV ₹ 4,950 (A); LEV ₹ 1,800 (A); (*c*) ₹ 4,000 (A), (*d*) ₹ 400 (A)]

38. (*a*) From the following data, calculate the following variances:

(*i*) Material cost variance; (*ii*) Material price variance;
(*iii*) Material quantity variance; (*iv*) Material mix variance;
(*v*) Material yield variance.

Materials	*Standard*		*Actual*	
	Qty.	*Price*	*Qty.*	*Price*
A	60%	₹ 20	88	₹ 30
B	40%	₹ 10	132	₹ 10

Standard loss : 10%

Actual output : 180 units

(*b*) A company has a normal capacity of 120 machines working 8 hours per day of 25 days in a month. The fixed overheads are budgeted ₹ 1,44,000 per month. The standard time required to manufacture one unit of production is 4 hours.

In April 2006, the company worked 24 days of 840 machine hours per day and produced 5,305 units of output. The actual fixed overheads were ₹ 1,42,000.

Compute:

(i) Efficiency variance; (ii) Capacity variance; (iii) Calender variance. (B.Com. Hons. Delhi)

[Ans. (a) (i) ₹ 760 (A); (ii) ₹ 880 (A); (iii) ₹ 120 (F); (iv) ₹ 440 (F); (v) ₹ 320(A)
(b) (i) ₹ 6,360 (F); (ii) ₹ 17,280 (A); (iii) ₹ 5,760 (A)]

39. (a) The standard labour cost for producing 200 metres of cloth was pre-determined as 20 skilled labour hours @ ₹ 15 per hour and 30 unskilled labour hours @ ₹ 10 per hour. 300 metres of cloth was produced with the help of 30 skilled labour hours paid @ ₹ 17 per hour and 30 unskilled labour hours paid @ ₹ 12 per hour.

Calculate :

(i) Labour mix variance, and (ii) Labour yield variance.

(b) Details of fixed overheads, production hours and production for a period are :

Budgeted hours	10,000 hours
Standard hours per unit of output	5 hours
Standard fixed overheads per hour	₹ 10
Actual production	1,920 units
Actual fixed overheads	₹ 94,000

Calculate :

(i) Fixed overhead cost variance; (ii) Fixed overhead expenditure variance, and (iii) Fixed overhead volume variance (B.Com. Hons. Delhi)

[Ans. (a) (i) LMV ₹ 30 (A); (ii) LYV ₹ 180 (F)
(b) (i) ₹ 2,000 (F); (ii) ₹ 6,000 (F); (iii) ₹ 4,000 (A)]

40. Following data is given

Product	Budget		Actual	
	Qty.	St. Price	Qty.	St. Price
N	8,000	₹ 12	9,000	₹ 11
K	12,000	₹ 9	6,000	₹ 10
Total	20,000		15,000	

Calculate (a) Sales Value Variance, (b) Sales Price Variance, (c) Sales Volume Variance, (d) Sales Mix Variance, (e) Sales Quantity Variance.

[Ans. (a) ₹ 45,000 (A), (b) ₹ 3,000 (A), (c) 42,000 (A), (d) ₹ 9,000 (F), (e) ₹ 51,000 (A)]

41. Budgeted and actual sales for the month of December, 2017 of two products A and B of Messrs. XY Ltd. were as follows:

Product	Budgeted units	Sales Price/Unit ₹	Actual Units	Actual Price/Unit ₹
X	6,000	5.00	5,000	5.00
			1,500	4.75
Y	10,000	2.00	7,500	2.00
			1,750	1.90

Budgeted costs for products X and Y were ₹ 4.00 and ₹ 1.50 per unit respectively. Work out from the above data the following variances:

(i) Sales value variance
(ii) Sales volume variance
(iii) Sales price variance
(iv) Sales mixture variance
(v) Sales quantity variance

[Ans. (i) ₹ 450 (F), (ii) ₹ 550 (A), (iii) ₹ 1,000(F) (iv) ₹ 1,782 (F), (v) ₹ 782 (A)]

42. Calculate (*a*) efficiency ratio and (*b*) activity ratio from the following data.

Budgeted production	90 units
Standard hours per unit	10
Actual production	8 units
Actual hours worked	2,000

(I.C.W.A. Inter,)

[Ans. (*a*) 40%, (*b*) 89% (Approx.)]

43. From the following data, calculate 'activity ratio' and efficiency ratio' : A factory manufactures two products '*A*' and '*B*'. Standard time to manufacture product '*A*' is 2 hours and product '*B*' 10 hours. The budgeted and actual production in December were as follows :

	Budgeted Production	*Actual production*
Product '*A*'	..... 125 units	100 units
Product '*B*'	..... 30 units	24 units

Total actual hours worked were 660.

(B.Com. Hons. Delhi; B.Com., Calicut;)

[Ans. Activity ratio 80%, Efficiency ratio $66\frac{2}{3}$ %]

CHAPTER 4

ABSORPTION COSTING Versus VARIABLE (MARGINAL) COSTING

CHAPTER OUTLINE

Introduction; Product costs and period costs; Absorption costing — meaning, characteristics and income determination; Marginal costing — meaning, characteristics and income determination; Distinction between absorption and marginal costing; Difference in profit under absorption and marginal costing; Advantages and disadvantages of marginal costing; Key terms; Problems and solutions; Examination questions.

Introduction

Absorption costing and variable costing are the two main techniques of cost ascertainment and income determination. The basic point of distinction between the two is regarding the treatment of fixed manufacturing overhead. In absorption costing, all variable manufacturing costs and also fixed manufacturing costs are included in the cost of products i.e. cost of goods produced includes all manufacturing costs. But under variable costing, only variable manufacturing costs are included in the cost of products but fixed manufacturing costs are considered as period costs and charged directly to Profit and Loss Account.

Both absorption costing and marginal costing treat non-manufacturing costs (*i.e.*, administration, selling and distribution overhead) as period costs.

Absorption costing is mostly used for external reporting and computation of taxable income. Variable costing is mostly used for internal reporting *i.e.*, it is used for managerial purposes.

PRODUCT COSTS AND PERIOD COSTS

Product costs are those costs which are necessary for production and which will not be incurred if there is no production. These consist of direct materials,direct labour and some of the factory overhead. Product costs are 'absorbed by' or 'attached to' the units produced. These are called inventoriable costs because these are included in the cost of inventory.

Period costs are those costs which are not necessary for production and are incurred even if there is no production. These are written off as expenses in the period in which these are incurred. Such costs are incurred for a time period and are charged to Profit and Loss Account of the period. Rent, salary of company executives, travel expenses are examples of period costs. These costs are not inventoried; *i.e.*, these are not included in the value of inventory. Administration and selling expenses are generally treated as period costs.

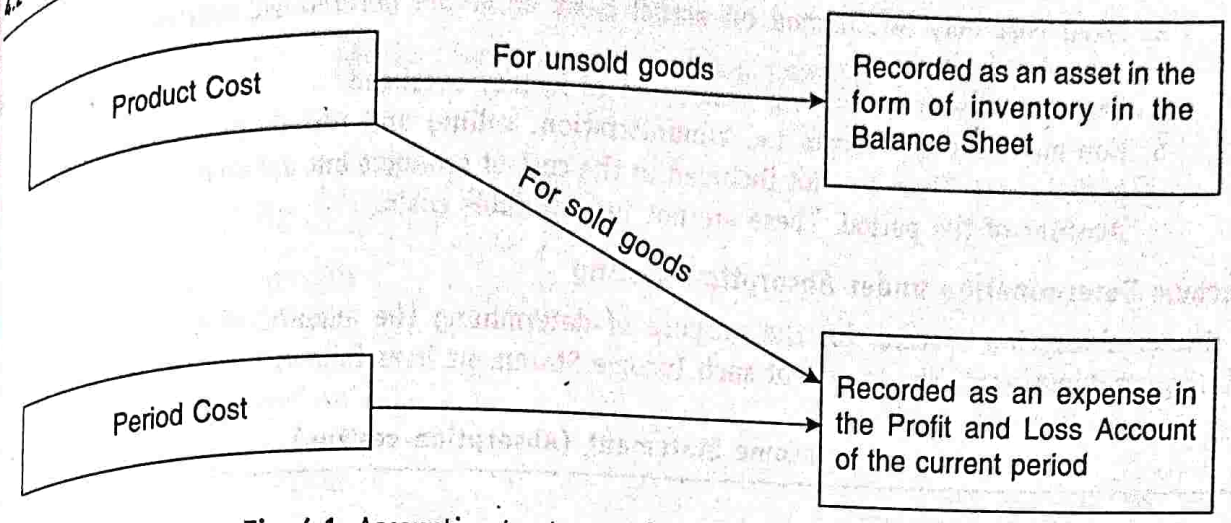
Product Cost
For unsold goods
Recorded as an asset in the form of inventory in the Balance Sheet
For sold goods
Period Cost
Recorded as an expense in the Profit and Loss Account of the current period

Fig. 4.1. Accounting treatment of product and period costs.

It is important to note that components of product cost and period cost are different in absorption costing and variable costing.

Classification into product and period cost is important from the point of view of profit determination. This is so because product cost is carried forward to the next accounting period as part of the unsold finished stock whereas period cost is written off in the accounting period in which it is incurred.

ABSORPTION COSTING

This is a total cost technique under which total cost (*i.e.*, variable manufacturing cost as well as fixed manufacturing cost) is charged as production cost. In other words, in absorption costing, all manufacturing costs are *'absorbed'* in the cost of the products produced. In this system, fixed factory overheads are absorbed on actual cost basis or on the basis of a predetermined overhead rate based on normal capacity. Under/over absorbed overhead are adjusted before computing profit for a particular period. Closing stock is also valued at total cost which includes fixed factory overhead (and sometimes administration overhead also). Absorption costing is a traditional approach and is also known as *'Total Costing'* or *'Full Costing'*.

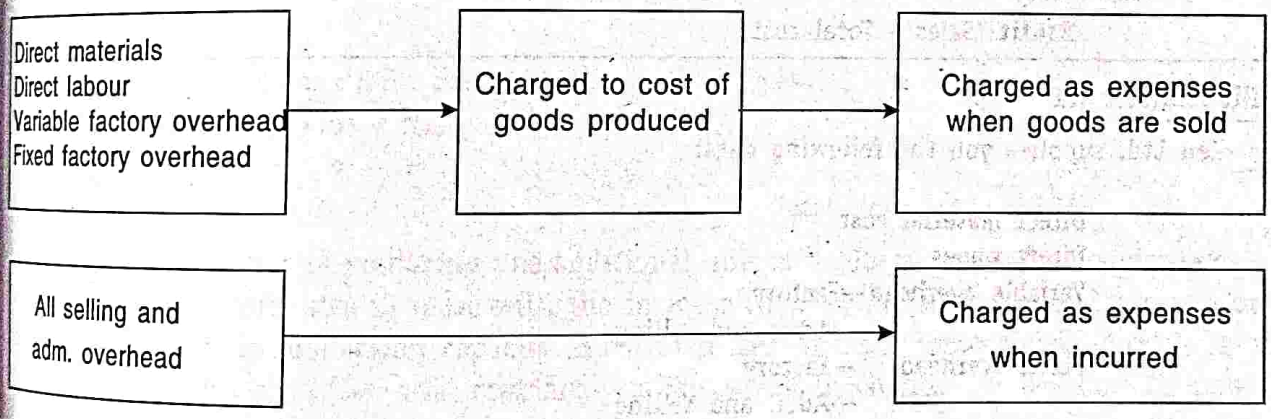
Direct materials
Direct labour
Variable factory overhead
Fixed factory overhead
Charged to cost of goods produced
Charged as expenses when goods are sold
All selling and adm. overhead
Charged as expenses when incurred

Fig. 4.2 Absorption Costing Approach

Characteristics. The main characteristics of absorption costing are as follows :

1. Both variable manufacturing costs and fixed manufacturing costs are charged to cost of products.
2. Stocks are also valued at total cost *i.e.* variable plus fixed cost.

3. Fixed cost may be charged on actual basis or at pre determined overhead rates based on normal capacity.
4. There may be under or over-absorption of factory overhead.
5. Non-manufacturing costs i.e. administration, selling and distribution costs are treated as period costs. Thses are not included in the cost of products but are charged to Profit and Loss Account of the period. These are not inventoriable costs.

Income Determination under Absorption Costing

Under absorption costing, for the purpose of determining the amount of profit/loss, an Income Statement is prepared. The format of such Income Statement is as follows :

Income Statement (Absorption costing)

			₹
Sales			xxxxx
Production Costs :			
	Direct material consumed		xxxxx
	Direct labour cost		xxxxx
	Variable manufacturing overhead		xxxxx
	Fixed manufacturing overhead		xxxxx
	Cost of goods produced		xxxxx
Add:	Opening stock of finished goods (valued at cost of previous period's production)		xxxxx
	Cost of Goods Available for sale		xxxxx
Less:	Closing stock of finished goods (valued at production cost of current period)		xxxxx
	Cost of goods sold		xxxxx
Add:	(or less) Under (or over) absorption of fixed manufacturing overhead		xxxxx
Add:	Selling and distribution costs	xxxxx	
	Administration costs	xxxxx	xxxxx
	Total Cost		xxxxx
	Profit (Sales – Total cost)		xxxxx

Illustration 4.1

Zen Ltd. supplies you the following data:

		₹
Direct material cost		48,000
Direct wages		22,000
Variable overhead	—Factory	13,000
	—Adm. and selling	2,000
Fixed overhead	—Factory	20,000
	—Adm. and selling	8,000
Sales		1,25,000

Prepare an income statement under absorption costing.

Solution **Income Statement (Absorption Costing)**

			₹
(A) Sales			1,25,000
Direct materials			48,000
Direct wages			22,000
Factory overhead	—Variable	13,000	
	—Fixed	20,000	33,000
Cost of Production			1,03,000
Adm. and selling overhead	—Variable	2,000	
	—Fixed	8,000	10,000
(B) **Total Cost**			1,13,000
Profit (A – B)			12,000

Meaning of Marginal Cost and Variable Cost

Marginal cost is the same as variable cost. Marginal cost is the additional cost of producing an additional unit of product. It is the total of all variable costs. It is composed of all direct costs and variable overheads. The CIMA London has defined marginal cost *'as the amount at any given volume of output by which aggregate costs are changed, if volume of output is increased or decreased by one unit'.* It is the cost of one unit of product which would be avoided if that unit were not produced. An important point is that variable cost per unit remains unchanged irrespective of the level of activity.

Example

A company manufactures 100 units of a product per month. Total fixed cost per month is ₹ 5,000 and marginal cost per unit is ₹ 250. The total cost per month will be :

	₹
Marginal (variable) cost of 100 units	25,000
Fixed cost	5,000
Total cost	30,000

If output is increased by one unit, the cost will appear as follows :

Marginal cost (101 × 250)	25,250
Fixed cost	5,000
Total cost	30,250

Thus the additional cost of producing one additional unit is ₹ 250, which is its marginal cost. However, where fixed costs also increase with the increase in the volume of output, this may be the result of increase in production capacity. Such increases in fixed costs are dealt with as a part of what is known as 'differential cost analysis' discussed in chapter on Decision Making.

Meaning of Variable Costing

Variable costing is defined by C.I.M.A. London as *"The accounting system in which variable costs are charged to cost units and fixed costs of the period are written off in full against the aggregate contribution. Its special value is in decision making".*

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Characteristics of Variable Costing

The essential characteristics and mechanism of marginal costing technique may be summed up as follows :

1. **Segregation of costs into fixed and variable elements.** In variable costing all costs, are classified into fixed and variable. Semi-variable costs are also segregated into fixed and variable elements.
2. **Variable costs as products costs.** Only marginal or variable costs are charged to products produced during the period.
3. **Fixed costs as period costs.** Fixed costs are treated as period costs and are charged to Costing Profit and Loss Account of the period in which they are incurred.
4. **Valuation of inventory.** The work-in-progress and finished stocks are valued at variable cost only.
5. **Contribution.** Contribution is the difference between sales value and variable cost of sales. The relative profitability of products or departments is based on a study of 'contribution' made by each of the products or departments.
6. **Marginal costing and profit.** In marginal costing, profit is calculated by a two stage approach. First of all, contribution is determined for each product or department. The contributions of various products or departments are pooled together and such a total of contributions from all products is called 'Fund'. Then from this fund is deducted the total fixed cost to arrive at a profit or loss.

Income Determination under Variable Costing

Income statement under variable costing is prepared in the following format :

Income Statement (Variable Costing)

		₹
	Sales	xxxxx
	Variable manufacturing costs	
	—Direct material consumed	xxxxx
	—Direct labour	xxxxx
	—Variable manufacturing overhead	xxxxx
	Cost of goods produced	xxxxx
Add:	Opening stock of finished goods (valued at variable cost of previous period)	xxxxx
	Cost of goods available for sale	xxxxx
Less:	Closing stock of finished goods (valued at current variable cost)	
	Cost of goods sold	xxxxx
Add:	Variable adm., selling and dist. overhead	xxxxx
	Total Variable Cost	xxxxx
	Contribution (Sales – Total variable cost)	xxxxx
Less:	Fixed costs (Production, adm., selling and dist.)	xxxxx
	Net Profit	xxxxx

Illustration 4.2

From the data given in Illustration 4.1, prepare an Income Statement under marginal costing.

Solution **Income Statement (Variable Costing)**

			₹
(A)	Sales		1,25,000
	Direct materials		48,000
	Direct wages		22,000
	Variable overhead —Factory		13,000
	—Adm. and selling		2,000
(B)	Variable cost		85,000
(C)	**Contribution** (A – B)		40,000
	Fixed overhead —Factory	20,000	
	—Adm. and selling	8,000	
(D)	Total fixed overhead		2,8000
	Profit (C – D)		12,000

Comments. Profit under absorption costing and variable costing is the same. This is because there are no opening and closing stocks. However, when there are opening and/or closing stocks, profit/loss under the two systems may be different.

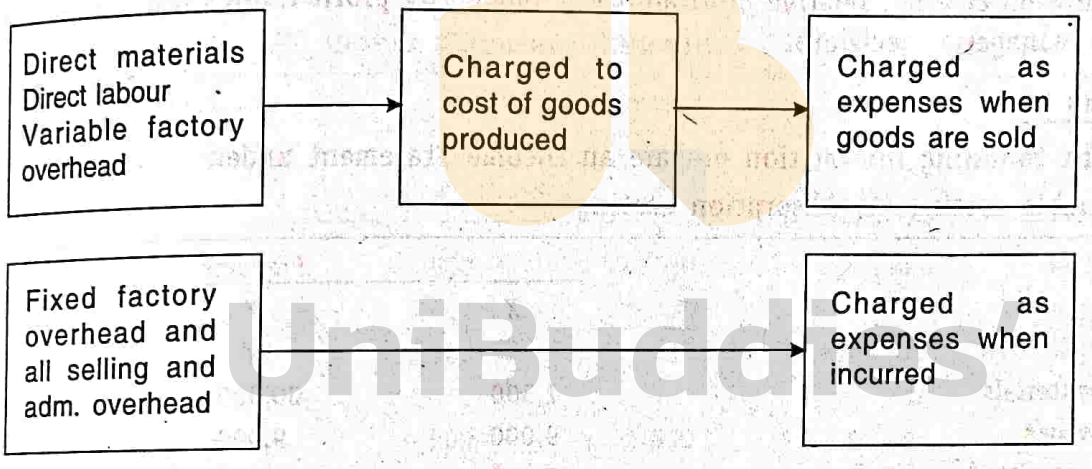
Direct materials
Direct labour
Variable factory overhead
Charged to cost of goods produced
Charged as expenses when goods are sold
Fixed factory overhead and all selling and adm. overhead
Charged as expenses when incurred

Fig. 4.3 Variable Costing Approach

Distinction between Absorption Costing and Variable Costing

The points of distinction between variable costing and absorption costing are summarised as follows:

1. **Treatment of fixed and variable costs.** Basic difference between absorption costing and marginal costing is in the treatment of fixed factory overhead. In variable costing, only variable costs are charged to products. Fixed costs are treated as period costs and charged to Profit and Loss Account of the period.

In absorption costing all costs (both fixed and variable) are charged to product. The fixed factory overhead is absorbed in units produced at actual basis or at a rate pre-determined on the basis of normal capacity utilisation.

Example

Product cost under the two systems is computed as follows :

	Absorption cost per unit	*Variable cost per unit*
	₹	₹
Direct materials	50	50
Direct labout	40	40
Variable factory overhead	25	25
Fixed factory overhead	12	—
Product cost	127	115

2. **Valuation of stock.** In variable costing, stock of work-in-progress and finished goods are valued at variable cost only.

In absorption costing, stocks are valued at total cost which includes both fixed and variable costs. Thus stock values in variable costing are lower than that in absorption costing.

3. **Measurement of profitability.** In variable costing, relative profitability of products or departments is based on a study of relative contribution made by respective products or departments. The managerial decisions are thus guided by contribution.

In absorption costing, relative profitability is judged by profit figures which is also a guiding factor for managerial decisions.

Illustration 4.3

From the following information prepare an Income Statement under:

(*a*) Variable costing (*b*) Absorption costing

		Products		
		X	*Y*	*Z*
		₹	₹	₹
Direct materials		7,500	30,000	3,000
Direct wages		9,000	9,000	1,500
Factory overhead	—Fixed	3,000	1,500	1,500
	—Variable	3,900	9,000	4,500
Selling overhead	—Fixed	1,500	900	600
	—Variable	2,100	6,000	3,000
Sales		32,000	61,000	16,000

Fixed factory overhead and fixed selling overhead were apportioned to products *X*, *Y*, and *Z* on equitable bases. (*B. Com.*,)

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Solution

(a) Income Statement (Variable Costing)

	Products			Total
	X	Y	Z	(X + Y + Z)
	₹	₹	₹	₹
(A) Sales	32,000	61,000	16,000	1,09,000
Variable costs:				
Direct materials	7,500	30,000	3,000	40,500
Direct wages	9,000	9,000	1,500	19,500
Variable overhead:				
Factory	3,900	9,000	4,500	17,400
Selling	2,100	6,000	3,000	11,100
Total Variable Cost (B)	22,500	54,000	12,000	88,500
Contribution (A – B)	9,500	7,000	4,000	20,500
Less: Fixed cost (Total of fixed factory and selling overhead)				9,000
Profit				**11,500**

(b) Income Statement (Absorption Costing)

	Products			Total
	X	Y	Z	(X + Y + Z)
	₹	₹	₹	₹
Direct materials	7,500	30,000	3,000	40,500
Direct wages	9,000	9,000	1,500	19,500
Prime cost	16,500	39,000	4,500	60,000
Factory overhead				
—Fixed	3,000	1,500	1,500	6,000
—Variable	3,900	9,000	4,500	17,400
Cost of Production	23,400	49,500	10,500	83,400
Selling overhead				
—Fixed	1,500	900	600	3,000
—Variable	2,100	6,000	3,000	11,100
Total cost	27,000	56,400	14,100	97,500
Profit	5,000	4,600	1,900	**11,500**
Sales	32,000	61,000	16,000	1,09,000

Comments It may be noted from the above that total profit under the marginal costing and absorption costing is the same, *i.e.*, ₹ 11,500. This is because there are no opening and closing stocks of finished goods or work-in-progress.

DIFFERENCE IN PROFIT UNDER VARIABLE COSTING AND ABSORPTION COSTING

Profit under the two systems may be different because of difference in the stock valuation. Position in this regard is summarised as follows :

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(a) Production equal to sales

(*i*) When there are no opening and closing stock, profit/loss under absorption and variable costing systems are equal.

(*ii*) When opening stock is equal to closing stocks then also profit/loss under the two systems will be equal provided the fixed cost element in opening and closing stocks is the same amount.

(b) Production more than sales

When production during a period is more than sales, *i.e.*, when closing stock is more than opening stock, the profit as per absorption costing will be more than that shown by variable costing. This is because in absorption costing a part of fixed overhead included in closing stock value is carried forward to next accounting period in the form of closing stock.

(c) Production less than sales

When production during a period is less than sales, *i.e.*, when opening stock is more than closing stock, profit shown by variable costing will be more than that shown by absorption costing. This is because under absorption costing, cost of goods sold is higher because a part of fixed cost from the preceding period is added to the current year's cost of goods sold in the form of opening stock.

To summarise the effect on profit of variable costing and absorption costing :

Effect of	*Profit in variable costing*	*Profit in absorption costing*
Production = Sales	Equal	Equal
Production > Sales	Lower	Higher
Production < Sales	Higher	Lower

ADVANTAGES AND DISADVANTAGES OF VARIABLE COSTING

Advantages. The following advantages are claimed for variable costing over total absorption costing:

1. **Help in managerial decisions.** The most important advantage of variable costing is the assistance that it renders to management in taking many valuable decisions. Information regarding variable cost and contributions provided by variable costing facilitates making policy decisions in problems like fixing selling prices below cost, make or buy, introduction of a new product line, utilisation of spare plant capacity, selection of the most profitable product mix, etc. This has been discussed in detail later in a separate chapter.
2. **Cost control.** Greater control over cost is possible. This is so because by classifying costs into fixed and variable, the management can concentrate more on the control of variable costs which are generally controllable and pay less attention to fixed costs which may be controlled only by the top management and that too, to a limited extent.
3. **Simple technique.** Variable costing is comparatively simple to operate because it avoids the complications involved in allocation, apportionment and absorption of fixed overheads which is, in fact, arbitrary division of indivisible fixed costs.
4. **No under and over-absorption of overheads.** In variable costing, there is no problem of under-or over-absorption of overheads.
5. **Constant cost per unit.** Variable costing takes into account only variable costs which remain the same per unit of product irrespective of the volume of output. It therefore

avoids the effect of varying cost per unit as it ignores fixed costs which are incurred on a time basis and have no relation with the size of production.

6. **Realistic valuation of stocks.** In variable costing, stocks of work-in-progress and finished goods are valued only at variable costs. Thus no fictitious profits can arise due to fixed cost being absorbed and capitalised in unsold stock. This is because variable costing prevents the carry forward in stock valuation of some portion of current year's fixed costs. Stock valuation in marginal costing, is, therefore more realistic and uniform.
7. **Aid to profit planning.** To aid profit planning variable costing technique enables data to be presented to management in such a way as to show cost-volume-profit relationship. Graphic presentation in the form of breakeven charts and profit-volume charts are also used to facilitate planning future performance.
8. **Valuable adjunct to other techniques.** Variable costing is a valuable adjunct to standard costing and budgetary control.

Disadvantages. The main disadvantages of variable costing are as follows :

1. **Difficult analysis.** Variable costing assumes that all costs can be analysed into fixed and variable elements. In practice however, it may be difficult to segregate all costs into fixed and variable components. Certain costs are caused purely by management decisions and cannot be strictly classified as fixed or variable, *e.g.*, ameneties to staff, bonus to workers, etc.
2. **Ignores time factor.** By ignoring fixed costs, time factor is also ignored. For instance, variable cost of two jobs may be identical but if one job takes twice as long to complete as the other, the true cost of the job taking longer time is higher than that of the other. This is not disclosed by variable costing. Production cannot be achieved without incurring fixed costs but variable costing creates an illusion that fixed costs have nothing to do with production.
3. **Difficulty in application.** It is difficult to apply variable costing technique in industries where large stocks of work-in-progress are locked up. Thus in ship building or construction contracts, if fixed overheads are not included in the valuation of work-in-progress, there may be losses in each year, while on the completion of contracts, there may be huge profits. Such fluctuations in profits can be avoided if total absorption costing is employed.
4. **Less effective in capital intensive industries.** In capital intensive industries, the proportion of fixed costs (like depreciation, maintenance etc.) is large. The variable costing technique, which ignores fixed cost, thus proves less effective in such industries. With the increased automation in industries, variable costing is, therefore, left with a limited scope.
5. **Improper basis of pricing.** Where prices are fixed by competition, variable costing gives the impression that so long as prices exceed variable cost, production is profitable. It ignores the danger of too much sales being made at variable cost or variable cost plus some contribution as it may result in overall losses. Although in certain circumstances product may be sold at less than total cost, prices in the long run must cover total cost as otherwise profit cannot be earned.

PROBLEMS AND SOLUTIONS

Problem 4.1

XYZ Ltd. supplies you the following data for the year ending 31st Dec, 2017.

Production—1,100 units, Sales 1,000 units

There was no opening stock.

Variable manufacturing cost per unit	₹	7
Fixed manufacturing overhead (total)	₹	2,200
Variable selling and administration overhead per unit	₹	0.50
Fixed selling and administration overhead (total)	₹	400
Selling price per unit	₹	15

Prepare

(*a*) Income statement under variable costing.
(*b*) Income statement under absorption costing.
(*c*) Explain the difference in profit under variable and absorption costing, if any.

(B.Com. Hons. Delhi, Adapted)

Solution

Income Statement (Absorption Costing)
for the year ended 31st Dec., 2017

		₹
Sales (1000 units @ ₹ 15)		15,000
Variable manufacturing overhead (1100 units @ ₹ 7)		7,700
Fixed manufacturing overhead (1100 units @ ₹ 2)		2,200
Cost of goods produced		9,900
Less: Closing stocks (100 units @ ₹ 9)*		900
Cost of goods sold		9,000
Add: Selling and adm. overhead		
—Variable (1000 units × ₹ 0.50)	500	
—Fixed	400	900
Total cost		9,900
Profit (Sales – Total Cost)		5,100

*Closing stock is valued at manufacturing cost per unit *i.e.*, ₹ 7 + 2 = ₹ 9 per unit.

Income Statement (Variable Costing)
for the year ending 31st Dec. 2017

			₹
Sales (1000 units @ ₹ 15)			15,000
Variable manufacturing cost (1100 units @ ₹ 7)			7,700
Less:	Closing Stock (100 units @ ₹ 7)		700
	Cost of goods produced		7,000
Add:	Variable selling and adm. overhead (1000 units @ ₹ 0.50)		500
	Total variable cost of goods sold		7,500
	Contribution (Sales–Total variable cost)		7,500
Less:	Fixed overhead		
	—Manufacturing	2,200	
	—Selling and adm.	400	2,600
Profit			4,900

Comments. Profit under absorption costing is ₹ 5,100 and under marginal costing ₹ 4,900. The difference of ₹ 200 in profit is due to over-valuation of closing stock in absorption costing by ₹ 200 (*i.e.*, ₹ 900 – 700).

Problem 4.2

XZED limited sells its products at ₹3 per unit. The company uses a First-In First-Out actual costing system. A new fixed manufacturing overhead allocation rate is computed each year by dividing the actual fixed manufacturing overhead cost by the actual production costs. The following simplified data are related to its first two years of operation:

	Year I	*Year II*
Sales (units)	1,000	1,200
Production (units)	1,400	1,000
Costs :	₹	₹
Variable manufacturing	700	500
Fixed manufacturing	700	700
Variable marketing and administration	1,000	1,200
Fixed marketing and administration	400	400

Required :

(*i*) Prepare income statements based on :
  (*a*) absorption costing and
  (*b*) variable costing for each year.

(*ii*) Give reasons for the difference in the answer.

(B. Com. Hons., Delhi)

Solution

Basic data	*Year I*	*Year II*
Production units	1400	1000
Sales units	1000	1200
Opening stock units	—	400
Closing stock units	400	200

Income Statement (Absorption Costing)

	Year I ₹	*Year II* ₹
Sales	3,000	3,600
Manufacturing cost – Variable	700	500
— Fixed	700	700
	1,400	1,200
Add: Opening stock*	—	400
Cost of Goods Available for Sale	1,400	1,600
Less: Closing stock*	400	240
Cost of Goods Sold	1,000	1,360
Marketing and administration costs.		
—Variable	1,000	1,200
—Fixed	400	400
Total cost	2,400	2,960
Net Income (Sales – Total cost)	600	640

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***Working Note**

Cost per unit year in I	= ₹ 1400 ÷ 1400 units	= ₹ 1
Cost per unit year in II	= ₹ 1200 ÷ 1000 units	= ₹ 1.20.
Closing stock value in year I	= 400 units @ ₹ 1	= ₹ 400.
Costing stock in year II	= 200 units @ ₹ 1.20	= ₹ 240.

Income Statement (Variable Costing)

	Year I ₹	*Year II* ₹
(*A*) Sales	3,000	3,600
Variable manufacturing cost	700	500
Add: Opening stock	–	200
Cost of Goods Available for Sale	700	700
Less: Closing stock	200	100
Cost of Goods Sold	500	600
Variable marketing and adm. cost	1,000	1,200
(*B*) Total variable cost	1,500	1,800
(*C*) **Contribution** (*A* – *B*)	1,500	1,800
Fixed cost—Manufacturing	700	700
—Administration	400	400
(*D*) Total Fixed Cost	1,100	1,100
Net Income (*C* – *D*)	400	700

Reason for difference in profit. Reason for difference in profit under absorption costing and marginal costing is the difference in the valuation of stocks.

In year I, profit under absorption costing is higher at ₹ 600 as compared to ₹ 400 in marginal costing. This is because closing stock is more than opening stock. In year II, profit under marginal costing is higher at ₹ 700 as compared to ₹ 640 in absorption. This is because opening stock is more than closing stock.

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Problem 4.3

Your company has a production capacity of 12,500 units and normal capacity utilisation is 80%. Opening inventory of finished goods on 1-1-2017 was 1,000 units. During the year ending 31-12-2017, it produced 11,000 units while it sold only 10,000 units.

Standard variable cost per unit is ₹ 6.50 and standard fixed factory cost per unit is ₹ 1.50 total fixed selling and administration overhead amounted to ₹ 10,000. The company sells its product at ₹ 10 per unit.

Prepare Income Statements under Absorption Costing and Variable Costing. Explain the reasons for difference in profit, if any. *(B.Com. Hons. Delhi)*

Solution

Income Statement (Absorption Costing)

	₹
Sales	1,00,000
Variable Cost—factory (11,000 units @ ₹ 6.50)	71,500
Fixed Cost—factory (11,000 units @ ₹ 1.50)	16,500
	88,000
Add: Opening Stock (1,000 units @ ₹ 8)	8,000
Cost of Goods Available for sale	96,000
Less: Closing Stock (2,000 units @ ₹ 8)	16,000
	80,000
Less: Over-absorption of overheads (1,000 units @ ₹ 1.50)	1,500
	78,500
Selling and administration expenses	10,000
Total cost	88,500
Profit	**11,500**

Income Statement (Variable Costing)

		₹
Sales (10,000 units @ ₹ 10)		1,00,000
Variable cost (11,000 units @ ₹ 6.50)		71,500
Add: Opening Stock (1,000 units @ ₹ 6.50)		6,500
Cost of Goods Available for sale		78,000
Less: Closing Stock (2,000 units @ ₹ 6.50)		13,000
Variable Cost of production		65,000
Contribution (Sales – Variable Cost)		35,000
Less: Fixed Cost : Factory	15,000	
Selling and administration	10,000	25,000
Profit		**10,000**

Reason for difference in Profit. Difference in profit under absorption costing and variable costing is ₹ 1,500 *i.e.*, ₹ 11500 – 10,000. This is due to the difference in the value of stocks under the two systems. In absorption costing, stocks are valued at total cost *i.e.*, ₹ 8 per unit whereas in variable costing, stocks are valued at variable cost only *i.e.*, ₹ 6.50.

Problem 4.4

The following is the standard cost data per unit of product 'X'

	₹
Selling price	40
Direct material	8
Direct labour	5
Variable factory overhead	2

Fixed factory overhead ₹ 5 (based on a budgeted normal output of 36,000 units per year)
Variable selling overhead ₹ 6
Fixed selling overhead per year were ₹ 1,20,000

During a month the company produced 2,000 units of the product and sold 1,500 units There was no opening stock.

You are required to prepare an income statement under (*i*) absorption costing, and (*ii*) variable costing. Explain the difference in profit if any. . *(C.S. Inter)*

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Solution

Income Statement (Absorption Costing)

		₹
Sales (1500 units × ₹ 40)		60,000
Production costs :		
Material (2,000 units × ₹ 8)		16,000
Labour (2,000 units × ₹ 5)		10,000
Variable factory overhead (2,000 units × ₹ 2)		4,000
Fixed factory overhead (2,000 units × ₹ 5)		10,000
Cost of goods produced		40,000
Less: Closing stock (500 units × ₹ 20)*		10,000
Cost of goods sold		30,000
Add : Under absorbed overhead*		5,000
		35,000
Add: Selling expenses – Variable (1,500 units × ₹ 6)		9,000
Fixed (₹ 1,20,000 ÷ 12 months)		10,000
Total cost of sales		54,000
Profit (Sales – Total cost)		6,000

***Working Notes:**

1. Closing stock is valued at production cost per unit *i.e.*, ₹ 40,000 ÷ 2,000 units = ₹ 20.
2. Fixed factory overhead per month (36,000 × ₹ 5) ÷ 12 months = ₹ 15,000
   Less: Fixed factory overhead absorbed (2,000 units × ₹ 5) = ₹ 10,000
   Under absorbed overhead ₹ 5,000

Income Statement (Variable Costing)

			₹
Sales (1,500 units × ₹ 40)			60,000
Variable production costs :			
Direct materials (2,000 units × 8)			16,000
Direct labour (2,000 units × 5)			10,000
Factory overhead (2,000 units × 2)			4,000
Total variable production cost			30,000
Less: Closing stock (500 units × ₹ 15)			7,500
			22,500
Add: Variable selling overhead (1,500 units × ₹ 6)			9,000
Total Variable cost			31,500
Contribution (Sales – Total variable cost)			28,500
Less: Fixed costs — Factory overhead		15,000	
— Selling overhead		10,000	25,000
Profit			3,500

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Difference in profit

Profit as per absorption costing	₹ 6,000
Profit as per marginal costing	₹ 3,500
Difference	₹ 2,500

Reason for Difference. This difference in profit is due to the differences in stock valuation under the two systems as explained below :

Stock valuation in absorption costing	₹10,000
Stock valuation in marginal costing	₹ 7,500
Difference	₹ 2,500

Problem 4.5

Top class company supplies you the following standard cost per unit for one of its products.

Direct material	₹ 1.60
Direct labour	₹ 1.50
Variable factory overhead	₹ 1.20
Fixed factory overhead	₹ 3.00

Production at normal capacity is 2,00,000 units. Variable selling and administrative overhead per unit is Re. 0.50 and fixed selling and administrative overhead are ₹ 75,000 per year. Production and sales data for the year 2016 and year 2017 are as follows :

Units produced in year 2016	2,00,000
Units sold in the year 2016	1,60,000
Inventory—31st Dec. 2016	68,000
Units produced in year 2017	1,50,000
Units sold in year 2017	1,80,000

Selling price in each year was ₹ 10.50. Prepare Income Statement for the two years under (*i*) Absorption costing, and (*ii*) Variable costing.

Solution

Basic Data

	Year 2016	*Year 2017*
Production units	2,00,000	1,50,000
Sales units	1,60,000	1,80,000
Opening inventory	28,000	68,000
Closing inventory	68,000	38,000

Income Statement (Absorption costing)

	Year 2016 ₹	*Year 2017* ₹
Sales (@ ₹ 10.50 per unit)	16,80,000	18,90,000
Direct materials (@ ₹ 1.60 per unit produced)	3,20,000	2,40,000
Direct labour (@ Re. 1.50 per unit)	3,00,000	2,25,000
Variable factory overhead (@ ₹ 1.20 per unit)	2,40,000	1,80,000
Fixed factory overhead (@ ₹ 3 per unit)	6,00,000	4,50,000
Production cost (@ ₹ 7.30 per unit)	14,60,000	10,95,000

(Contd...)

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	2,04,400	4,96,400
Add: Openning inventory (@ ₹ 7.30 per unit)	16,64,400	15,91,400
	4,96,400	2,77,400
Less: Closing inventory (@ ₹ 7.30 per unit)	11,68,000	13,14,000
Cost of Goods Sold	—	1,50,000
Add: Under-absorbed fixed overhead (50,000 units @ ₹ 3)	11,68,000	14,64,000
Total Manufacturing Cost		
Selling and Adm. overhead	80,000	90,000
—Variable (@ ₹ 0.50 per unit sold)	75,000	75,000
—Fixed	13,23,000	16,29,000
Total Cost	3,57,000	2,61,000
Profit (Sales – Total cost)		

Income Statement (Variable Costing)

	Year 2016 ₹	*Year 2017* ₹
Sales (@ ₹ 10.50 per unit)	16,80,000	18,90,000
Variable Costs :		
Direct materials (@ ₹ 1.60 p.u. produced)	3,20,000	2,40,000
Direct labour (@ ₹ 1.50 p.u.)	3,00,000	2,25,000
Variable factory overhead (@ ₹ 1.20 p.u.)	2,40,000	1,80,000
Production cost (@ ₹ 4.30 p.u.)	8.60,000	6,45,000
Add: Openning inventory (@ ₹ 4.30 p.u.)	1,20,400	2,92,400
	9,80,400	9,37,400
Less: Closing inventory (@ ₹ 4.30 p.u.)	2,92,400	1,63,400
Cost of Goods Sold	6,88,000	7,74,000
Add: Variable selling and adm. overhead	80,000	90,000
Total cost (variable)	7,68,000	8,64,000
Contribution (Sales – Total variable cost)	9,12,000	10,26,000
Fixed overhead —Factory	6,00,000	6,00,000
—Selling and adm.	75,000	75,000
Total fixed cost	6,75,000	6,75,000
Profit (Contribution – Fixed cost)	2,37,000	3,51,000

Comments

Year 2016—Closing stock is more than opening stock (production is more than sales), profit shown by absorption costing is more than that of marginal costing.

Year 2017—Closing stock is less than opening stock (sales are more than production), profit shown by marginal costing is more than that of absorption costing.

Problem 4.6

SK+F Co. is currently working at 50% capacity and produces 10,000 units. At 60% working raw material cost increases by 2% and selling price falls by 2%. At 80% working raw material cost increases by 5% and selling price falls by 5%.

At 50% capacity working the product costs ₹ 180 per unit and is sold at ₹ 200 per unit. The unit cost of ₹ 180 is made up as follows :

Material	₹ 100
Wages	₹ 30
Factory overheads	₹ 30 (40% fixed)
Administration overheads	₹ 20 (50% fixed)

Prepare a Marginal Cost Statement showing the estimated profit of the business when it is operated at 60% and 80% capacity. Also calculate break even points at these levels.

(B.Com. Hons., Delhi)

Solution

Marginal Cost Statement

Items	*50% capacity (10,000 units)*		*60% capacity (12,000 units)*		*80% capacity (16,000 units)*	
	Per unit ₹	*Total* ₹	*Per unit* ₹	*Total* ₹	*Per unit* ₹	*Total* ₹
(A) Sales	200	20,00,000	196	23,52,000	190	30,40,000
Material cost	100	10,00,000	102	12,24,000	105	16,80,000
Wages	30	3,00,000	30	3,60,000	30	4,80,000
Variable factory overhead	18	1,80,000	18	2,16,000	18	2,88,000
Variable Adm. overhead	10	1,00,000	10	1,20,000	10	1,60,000
(B) Marginal cost	158	15,80,000	160	19,20,000	163	26,08,000
(C) Contribution (A–B)	42	4,20,000	36	4,32,000	27	4,32,000
Fixed overheads:						
—Factory	12	1,20,000	10.00	1,20,000	7.50	1,20,000
—Administration	10	1,00,000	8.33	1,00,000	6.25	1,00,000
(D) Total fixed cost (F)	22	2,20,000	18.33	2,20,000	13.75	2,20,000
Profit (C – D)	20	2,00,000	17.67	2,12,000	13.25	2,12,000
B.E. Point = $\frac{F}{C}$		= $\frac{2,20,000}{42}$ = 5,238 units		= $\frac{2,20,000}{36}$ = 6,111 units		= $\frac{2,20,000}{27}$ = 8,148 units

Notes: 1. At 60% material cost is ₹ 100 + 2% = ₹ 102 per unit
At 80% material cost is ₹ 100 + 5% = ₹ 105 per unit

2. At 60% selling price is ₹ 200 – 2% = ₹ 196 per unit
At 80% selling price is ₹ 200 – 5% = ₹ 190 per unit

3. Factory overhead :
Fixed – ₹ 30 × 40% = ₹ 12 per unit.
Variable (₹ 30 – 12) = ₹ 18 per unit.
Total fixed factory overheads = (10,000 units × ₹ 12) = ₹ 1,20,000.

At 60% fixed factory overhead per unit will decrease, *i.e.*, 1,20,000 ÷ 12,000 = ₹ 10.

At 80% fixed overhead per unit will further decrease, *i.e.*, 1,20,000 ÷ 16,000 = ₹ 7.50

Variable overhead per unit will not change but will increase in total when production increases to 60% and 80%.

Similar calculation can be made for administration fixed overheads.

Problem 4.7

A company produces an item which it sells for ₹ 5.20 per unit. The production costs are as follows :

Fixed production costs per year ₹ 2,25,000

Variable production costs per unit ₹ 1.25

Normal level of activity is 1,50,000 units per year

At the beginning of the year, the Position Statement of the company was as follows :

Position Statement as at January Year I

	₹		₹
Capital	80,000	Finished Goods*	27,500
Retained earnings	22,500	Other Assets	75,000
	1,02,500		1,02,500

*Finished goods represent 10,000 units (₹ 12,500 of variable costs and ₹ 15,000 of fixed costs).

The information for the years I and II is as follows :

Year	*Sales (units)*	*Production (units)*
I	1,00,000	1,25,000
II	1,00,000	80,000

You are required to prepare :

(*i*) Income statement for each of the two years on the basis of absorption costing using normal activity as the basis of overhead absorption; and

(*ii*) Income statements for the two years, under variable costing system. (*B. Com Hons. Delhi*)

Solution

Basic data

	Year I	*Year II*
Production units	1,25,000	80,000
Sales units	1,00,000	1,00,000
Opening inventory units	10,000	35,000
Closing inventory units	35,000	15,000

Pre-determined fixed overhead rate per unit

$$= \frac{\text{Fixed overhead}}{\text{Normal output in units}} = \frac{₹\ 2,25,000}{1,50,000 \text{ units}} = ₹\ 1.50$$

Income Statement (Absorption Costing)

	Year I ₹	Year II ₹
(A) Sales (1,00,000 units @ ₹ 5.20)	5,20,000	5,20,000
Variable cost @ ₹ 1.25 p.u.	1,56,250	1,00,000
Fixed cost @ ₹ 1.50 p.u.	1,87,500	1,20,000
Add : Opening stock — Variable cost	12,500	43,750
— Fixed cost	15,000	52,500
Less: Closing stock — Variable cost	(–) 43,750	(–) 18,750
— Fixed cost	(–) 52,500	(–) 22,500
	2,75,000	2,75,000
Add : Under absorption of fixed overhead*	37,500	1,05,000
(B) Cost of Goods sold	3,12,500	3,80,000
Profit (A – B)	**2,07,500**	**1,40,000**

***Note.** In absorption costing, factory overheads are absorbed at a predetermined rate of ₹ 1.50 per unit. Under absorbed overhead is the difference between absorbed overhead and actual amount of overhead.

Income Statement (Variable Costing)

	Year I ₹	Year II ₹
(A) Sales	5,20,000	5,20,000
Variable cost of goods produced	1,56,250	1,00,000
Add: Opening stock @ ₹ 1.25 p.u.	12,500	43,750
Less: Closing stock @ ₹ 1.25 p.u.	(–) 43,750	(–) 18,750
(B) Cost of goods sold	1,25,000	1,25,000
Contribution (A – B)	3,95,000	3,95,000
Less: Fixed cost	2,25,000	2,25,000
Profit	**1,70,000**	**1,70,000**

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KEY TERMS

Absorption costing It is a traditional method of income determination under which all manufacturing costs (variable and fixed) are treated as Product Costs while non-manufacturing costs (e.g., selling and administrative expenses) are treated as Period Costs.

Marginal or variable costing It is a managerial technique of income determination under which, only variable manufacturing costs are treated as products costs and all fixed manufacturing costs and all non-manufacturing costs are treated as period costs and charged directly to Profit and Loss Account.

Product cost–These are inventoriable costs *i.e.*, which are included in the cost of the products. In absorption costing, it includes direct materials, direct materials, direct labour and factory overhead (fixed + variable). In variable costing it includes direct materials, direct labour and only variable factory overhead.

Period costs– These are the cost which are not included in the cost of products *i.e.*, these are not inventoried. In absorption costing it includes administration, selling and distribution overhead. In variable costing it includes fixed factory overhead, admistration, selling and distribution overhead.

EXAMINATION QUESTIONS

Objective Type Questions

True or False ?

1. Absorption costing is a total cost technique.
2. There can be under or over absorption of overhead in variable costing and absorption costing.
3. Variable costing is more widely used than absorption costing for external reporting.
4. Under absorption costing, inventory valuation is at total cost.
5. For calculating taxable income, variable costing is acceptable.
6. Variable costing shows higher profit when production is more than sales.
7. When opening stock is more than closing stock, variable costing shows higher profit than absorption costing.
8. Variable costing is used mainly for internal reporting.
9. Selling and distribution costs are treated as period cost under both variable costing and absorption costing.
10. In absorption costing, semi-variable costs must be segregated into fixed and variable elements.

[**Ans.** 1. True; 2. False; 3. False; 4. True; 5. False; 6. False; 7. True; 8. True; 9. True; 10. False]

Essay Type Questions

1. Distinguish between marginal costing and absorption costing. *(B.Com., Hons., Delhi)*
2. What do you mean by marginal costing. Discuss its usefulness and limitations. *(B.Com., Andhra; Delhi; M.Com., Bangalore)*
3. Distinguish between marginal costing and total costing. *(B.B.M., Bangalore)*
4. What are the characteristic of marginal costing? *(B.Com., Mysore)*
5. Define marginal cost and marginal costing. How would you treat variable cost and fixed costs in marginal costing? *(C.S. Inter)*
6. "Absorption costing income exceeds variable costing income when the number of unitssold exceeds the number of units produced". Do you agree? *(B.Com. Hons., Delhi)*
7. "Marginal costing rewards sales whereas absorption costing rewards production." Comment. *(I.C.W.A. Inter)*
8. Which costs are to be inventorised in absorption costing for external reporting. Give reasons for your answers. *(B.Com., Hons., Delhi)*
9. State the distinction between marginal cost and absorption cost as regards valuation of finished goods inventories. *(C.S. Inter)*
10. Explain the concept of marginal costing. Describe the characteristics and limitations of marginal costing. *(B.Com., Hons., Delhi)*
11. Define marginal costing. Explain its managerial uses. *(C.S. Inter; M.Com., Madurai)*

Practical Questions

1. From the following information prepare an income statement under (*a*) Absorption costing, and (*b*) variable costing.

	₹		₹
Sales	1,50,000	Adm. overhead —Fixed	5,000
Direct materials	50,000	—Variable	12,000
Direct labour	20,000	Selling overhead —Fixed	20,000
Fixed factory overhead	10,000	—Variable	15,000
Variable factory overhead	5,000		

(Adapted)

[Ans. Profit ₹ 13,000 under both (*a*) and (*b*)]

2. The following information is given for the year ending 31st Dec. 2017.

Opening stock	— 1000 units valued at ₹ 70,000 (including variable cost of ₹ 50 per unit).
Variable cost	— ₹ 60 per unit
Fixed cost (Total)	— ₹ 1,20,000
Production	— 10,000 units
Sales	— 8,000 units at ₹ 90 per unit.

Prepare income statement under (*a*) absorption costing, and (*b*) variable costing.

(B.Com., Hons, Delhi, Adapted)

[Ans. Profit under absorption costing ₹ 1,46,000; Profit under variable costing ₹ 1,30,000]

3. The following information is given for the year ending 31st Dec, 2017:

	₹
Sales (@ ₹ 50 per unit)	10,00,000
Direct material	2,90,000
Direct labour	3,10,000
Variable factory overhead	1,20,000
Fixed factory overhead	2,40,000
Selling and administration overhead (fixed)	60,000
Selling and administration overhead (variable)	20,000

During the year 24,000 units were produced but only 20,000 units were sold. There was no opening stock.

Prepare an income statement under—

(*a*) Absorption costing, and

(*b*) Variable costing

Explain the difference in profit, if any. *(Adapted)*

[Ans. Profit—absorption costing ₹ 1,20,000; variable costing ₹ 80,000]

Closing stock valuation in absorption costing @ ₹ 40 per unit, variable costing @ ₹ 30 per unit]

4. Add Cello Co. manufacturing ball pens is working at 40% capacity producing 10,000 pens per year. The cost elements for each ball pen are given as under :

Material	— ₹ 20
Labour	— ₹ 6
Overheads	—₹ 10 (40% variable)

Each ball pen sells for ₹ 40. The selling price falls by 3% if production is at 50% capacity and by 5% if worked at 90% capacity. The fall in selling prices is accompanied by similar fall in material prices.

You are required to find out profit at 50% and 90% capacities using marginal costing approach.

(Adapted)

[Ans. Profit at 50% capacity ₹ 57,500; 90% capacity ₹ 1,42,500]

5. Using the information given below prepare operating statements for the months of June and July using: (*i*) Variable costing and (*ii*) Absorption costing.

Suggest reasons why the two techniques disclose different amounts of profit.

Selling price	₹ per unit 50	**Monthly costs :**	
Direct material cost	18	Fixed production overheads	₹ 99,000
Direct labour cost	4	Fixed selling expenses	₹ 15,000
Variable production overheads	3	Fixed administration expenses	₹ 25,000

Variable selling costs are 10% of sales revenue and normal production capacity is 11,000 units per month.

	Sales (units)	*Production (units)*
June	10,000	12,000
July	12,000	10,000

(B.Com., Osmania)

[**Ans.** June : Profit—Variable costing ₹ 61,000; Absorption costing ₹ 79,000;
July Profit—Variable costing ₹ 1,01,000; Absorption costing ₹ 83,000]

(**Hint :** There is over absorption of fixed production overhead in June of ₹ 9,000 in absorption costing. In July, there is under absorption of ₹ 9,000)

6. *X* Ltd. produces a product which has the following costs :

Variable manufacturing cost	— ₹ 4 per unit.
Fixed manufacturing cost	— ₹ 2,00,000 per year
Normal capacity	— 2,00,000 units

There are no work in progress inventories.

In year I, the company produced 2,00,000 units and sold 90% at a price of ₹ 7 per unit. In the year II the company produced 2,10,000 units and had sold 2,15,000 units at the same price.

Prepare Income Statement for two years based on

(*a*) Absorption costing.

(*b*) Marginal costing.

[**Ans.** (*a*) Absorption costing profit year I ₹ 3,60,000, II ₹ 4,40,000;
(*b*) Marginal costing profit year I ₹ 3,40,000, II ₹ 4,45,000).

7. The data given below relates to a company which makes and sells calculators.

		Jan.	*Feb.*
Sales in units		5,000	10,000
Production in units		10,000	5,000
Selling price per unit	₹	100	100
Variable production cost per unit	₹	50	50
Fixed production overhead	₹	1,00,000	1,00,000
Fixed production overhead per unit (pre-determined absorption rate)	₹	10	10
Selling and distribution costs (fixed)	₹	50,000	50,000

Prepare income statement under (*a*) absorption costing, and (*b*) marginal costing. Comment on the results.

(I.C.W.A. Inter)

[**Ans.** Absorption costing profit—Jan. ₹ 1,50,000, Feb. ₹ 3,00,000.
Marginal costing profit — Jan. ₹ 1,00,000 Feb. ₹ 3,50,000;
Overall profit for the two months is the same under the two systems]

CHAPTER 5

COST-VOLUME-PROFIT ANALYSIS (Break-even Analysis)

CHAPTER OUTLINE

Introduction; Meaning of CVP analysis; Break-even analysis; Assumptions; Contribution and marginal cost equation; P/V ratio; Calculations in break-even analysis; Margin of safety; Key factor; Angle of incidence; Break-even chart; Profit volume chart; Uses and limitations of Break-even analysis; Summary of formulae; Problems and solutions; Key terms; Examination questions.

Introduction

Cost-volume-profit analysis (CVP analysis) is an extension of the principles of variable costing. Thus our study of CVP analysis begins from where we left our study of variable costing in the previous chapter. CVP analysis follows directly from variable costing. This means that principles derived and applied in variable costing are applicable here.

Every company must earn profits to stay in business. CVP analysis helps management in profit planning. Managers make various plans to increase company profitability. For example, how the profits will be affected if an additional sales promotional expenditure of ₹ 2,00,000 increases sales by 40,000 units? Similarly, how many units of product should be sold to earn a profit of ₹ 2,50,000? If company sells 1,50,000 units, what will be the amount of profit ? These and many other similar questions find their answers in the study of CVP analysis.

COST-VOLUME-PROFIT ANALYSIS

CVP analysis is a powerful tool of profit planning. It studies the inter-relationship of three basic factors of business operations:

(*a*) **Cost** of production,

(*b*) **Volume** of production/sales, and

(*c*) **Profit.**

These three factors are inter-connected in such a way that they act and react on one another because of cause and effect relationship amongst them. The cost of a product determines its selling price and the selling price determines the level of profit. The selling price also affects the volume of sales which directly affects the volume of production and volume of production in turn

influences cost. In brief, variations in volume of production results in changes in cost and profit. CIMA London has defined CVP analysis as, *"the study of the effects on future profits of changes in fixed cost, variable cost, sales price, quantity and mix."*

An understanding of CVP analysis is extremely useful to management in budgeting and profit planning. It explains the impact of the following on the net profit :

(*a*) Changes in selling prices,
(*b*) Changes in volume of sales,
(*c*) Changes in variable cost,
(*d*) Changes in fixed cost.

Infact, CVP analysis helps in determining the probable effect of change in any one of these factors on the remaining factors.

BREAK-EVEN ANALYSIS

Break-even analysis is a widely used technique to study the CVP relationship. It is interpreted in narrow as well as broad sense.

Narrow meaning. In its *narrow sense*, break-even analysis is concerned with determining break-even point, *i.e.*, that level of production and sales where there is no profit and no loss. At this point total cost is equal to total sales revenue.

Broad meaning. When used in *broad sense*, break-even analysis is used to determine probable profit/loss at any given level of production/sales. It also helps to determine the amount or volume of sales to earn a desired amount of profit.

Assumptions underlying Break-even Analysis and CVP Analysis

The break-even analysis is based on the following eight assumptions :

1. All costs can be separated into fixed and variable components.
2. Variable cost per unit remains constant and total variable cost varies in direct proportion to the volume of production.
3. Total fixed cost remains constant.
4. Selling price per unit does not change as volume changes.
5. There is only one product or in the case of multiple products, the sales mix does not change. In other words, when several products are being sold, the sale of various products will always be in some predetermined proportion.
6. There is synchronisation between production and sales. In other words, volume of production equals volume of sales.
7. Productivity per worker does not change.
8. There will be no change in the general price level.

Contribution and Marginal Cost Equation

As stated earlier, contribution is the difference between sales and the marginal (variable) cost of sales. It is also known as contribution margin (C_m) or gross margin. Thus contribution is calculated by the following formula :

Contribution = Sales – Variable cost $(C = S - V)$

Also, Contribution = Fixed cost + Profit $(C = F + P)$

or Contribution = Fixed cost − Loss $(C = F - L)$

From this, the following marginal cost equation is developed :

$$S - V = F + P$$

If any three of the above four factors in the equation are known, the fourth one can be easily found out. Thus :

$$P = S - V - F$$
$$P = C - F$$
$$F = C - P$$
$$V = S - F - P$$

Example:

Sales = ₹ 12,000
Variable cost = ₹ 7,000
Fixed cost = ₹ 4,000

Thus :

$$C = S - V$$
$$C = 12,000 - 7,000 = ₹\ 5,000$$
$$P = C - F$$
$$P = 5,000 - 4,000 = ₹\ 1,000$$

Thus profit is ₹ 1,000.

If sales figure is not given but contribution is given then sales can be determined as follows :

$$S = C + V$$
$$S = 5,000 + 7,000 = ₹\ 12,000$$

When fixed cost (F) is not given but profit is given, then :

$$F = C - P$$
$$F = 5,000 - 1,000 = ₹\ 4,000$$

When variable cost (V) is not given, then :

$$V = S - C$$
$$V = 12,000 - 5,000 = ₹\ 7,000$$

The concept of contribution is extremely helpful in the study of break-even analysis and management decision-making.

Illustration 5.1

Calculate contribution in each of the following independent situations :

(*i*) Fixed cost ₹ 8,000, profit ₹ 5,600

(*ii*) Variable cost ₹ 7,000, sales ₹ 11,000

(*iii*) Contribution per unit ₹ 7, profit ₹ 3,000, B.E. Point 2,000 units.

Solution

(*i*) Contribution = Fixed cost + Profit
= 8,000 + 5,600 = **₹ 13,600**

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(ii) Contribution = Sales – Variable cost
= 11,000 – 7,000 = ₹ 4,000

(iii) Contribution = (B.E. Point (units) × Contribution per unit) + Profit
= (2,000 × ₹ 7) + 3,000 = ₹ 17,000

PROFIT-VOLUME RATIO (P/V RATIO)

The profit/volume ratio, better known as contribution/sales ratio (C/S ratio), express the relation of contribution to sales.

$$\text{Symbolically, P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{C}{S} = \frac{S-V}{S}$$

By transposition, we have

(i) $C = S \times \text{P/V ratio}$

(ii) $S = \frac{C}{\text{P/V ratio}}$

Example:

Sales = ₹ 10,000
Variable cost = ₹ 8,000

$$\text{Then P/V ratio} = \frac{C}{S} = \frac{S-V}{S} = \frac{10,000-8,000}{10,000} = \frac{2,000}{10,000} = \frac{2}{10}$$

When expressed in percentage, $\text{P/V ratio} = \frac{2}{10} \times 100 = 20\%$.

When P/V ratio is given, the contribution can be quickly calculated from any given level of sales. In the above example, if only sales and P/V ratio were given, contribution can be calculated as under :

$C = S \times \text{P/V ratio}$
$C = 10,000 \times 20\% = ₹ 2,000$

P/V ratio may also be computed by comparing the change in contribution to change in sales (or change in profit to change in sales.) Any increase in profit will mean increase in contribution because fixed costs are assumed to remain constant at all levels of production. Thus :

$$\text{P/V ratio} = \frac{\textit{Change in contribution}}{\textit{Change in sales}} = \frac{\textit{Change in profit}}{\textit{Change in sales}}$$

Example :

Year	*Sales* ₹	*Net Profit* ₹
2011	20,000	1,000
2012	22,000	1,600

$$\text{P/V ratio} = \frac{\textit{Change in profit}}{\textit{Change in sales}} = \frac{1,600-1,000}{22,000-20,000} \times 100$$

$$= \frac{600}{2,000} \times 100 = 30\%.$$

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Illustration 5.2

Calculate P/V ratio in each of the following independent situations.

(i) Variable cost ₹ 60, Contribution ₹ 40

(ii) Sales ₹ 20, variable cost ₹ 15

(iii) Ratio of variable cost to sales 84%

(iv) Profit ₹ 5,000; Sales ₹ 25,000; Fixed Cost ₹ 8,000

(v) Year I Sales ₹ 50,000, Total cost ₹ 40,000.
Year II Sales ₹ 60,000, Total cost ₹ 45,000

Solution

(i) $\text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{\text{Contribution}}{\text{Variable cost + Contribution}} = \frac{40}{60+40} = \frac{40}{100} = 40\%$

(ii) $\text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{S-V}{S} = \frac{20-15}{20} = \frac{5}{20} = 25\%$

(iii) P/V ratio = 100 – Variable cost to sales ratio
= 100 – 84% = **16%.**

(iv) $\text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{F+P}{S} = \frac{5,000+8,000}{25,000} = \frac{13,000}{25,000} = \frac{13}{25}$

(v) $\text{P/V ratio} = \frac{\text{Change in profit}^*}{\text{Change in sales}} = \frac{15,000-10,000}{60,000 - 50,000} = \frac{5,000}{10,000} = 50\%$

*Profit is the difference between sales and total cost.

Uses of P/V ratio

P/V ratio is one of the most important ratios to watch in business. It is an indicator of the rate at which profit is being earned. A high P/V ratio indicates high profitability and a low ratio indicates low profitability in the business. The profitability of different sections of the business such as sales areas, classes of customers, product lines, methods of production, etc., may also be compared with the help of profit-volume ratio. The P/V ratio is also used in making the following type of calculations:

(a) Calculation of break-even point.

(b) Calculation of profit at a given level of sales.

(c) Calculation of the volume of sales required to earn a given profit.

(d) Calculation of profit when margin of safety is given.

(e) Calculation of the volume of sales required to maintain the present level of profit, if selling price is reduced.

Improvement in P/V Ratio

As P/V ratio indicates the rate of profitability, any improvement in this ratio without increase in fixed cost would result in higher profits. As a note of caution, erroneous conclusions may be drawn by mere reference to P/V ratio. Therefore, this ratio should not be used in isolation.

P/V ratio is the function of sales and variable cost. Thus, it can be improved by widening the gap between sales and variable cost. This can be achieved by :

(a) Increasing the selling price

(b) Reducing the variable cost

(c) Changing the sales mix, *i.e.*, selling more of those products which have larger P/V ratio, thereby improving the overall P/V ratio.

METHODS OF BREAK-EVEN ANALYSIS

Break-even analysis may be performed by the following two methods :

(a) Algebraic calculations

(b) Graphic presentation

Algebraic Method (Calculations in Break-even Analysis)

Break-even point. The break-even point is the volume of output or sales at which total cost is exactly equal to sales. It is a point of no profit and no loss. This is the minimum point of production at which total cost is recovered and after this point profit begins.

The fundamental formula to calculate break-even point is :

Break-even point (in units)	$= \frac{\text{Total fixed cost}}{\text{Contribution per unit}} = \frac{F}{S-V}$
Break-even point (in Rupees)	$= \frac{\text{Total fixed cost}}{\text{Contribution}} \times \text{Sales} = \frac{F \times S}{S-V}$
or Break-even point (in Rupees)	$= \frac{\text{Total fixed cost}}{\text{P/V ratio}}$

Example

Following data is given :

Total fixed cost = ₹ 12,000

Selling price = ₹ 12 per unit

Variable cost = ₹ 9 per unit

Thus :

Contribution $= S - V$

$= 12 - 9 =$ ₹ 3 per unit

P/V ratio $= \frac{C}{S} \times 100 = \frac{3}{12} \times 100 = 25\%$

Break-even point (in units) $= \frac{\text{Fixed cost}}{\text{Contribution per unit}} = \frac{12,000}{3} = 4,000$ units.

Break-even point (in ₹) $= \frac{\text{Total fixed cost}}{\text{Contribution}} \times \text{Sales}$

$= \frac{12,000}{3} \times 12 =$ ₹ 48,000

Also,

Break-even point (in ₹) $= \frac{\text{Total Fixed cost}}{\text{P/V ratio}} = \frac{₹\ 12,000}{25\%} =$ ₹ 48,000

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Verification

Break-even point may be verified as follows :

Total cost = Fixed cost + Variable cost
Total cost = ₹ 12,000 + (4,000 units × ₹ 9)
= ₹ 48,000

The sales value and total cost at break-even point are exactly equal.

ADDITIONAL CALCULATIONS

In addition to the calculation of break-even point, the above formula can also be used in making certain additional calculations. These are :

1. Calculation of profit at different sales volumes.
2. Calculation of sales for desired profit.
3. Finding missing figures.

Example

The following data is given :

Fixed cost = ₹ 12,000 (total)
Selling price = ₹ 12 per unit
Variable cost = ₹ 9 per unit

Calculation of Profit at different Sales Volumes

What will be the profit when sales are (*a*) ₹ 60,000 (*b*) ₹ 1,00,000 ?

$$\text{P/V ratio} = \frac{C}{S} = \frac{3}{12} = 25\%$$

(*a*) When sales = ₹ 60,000
Contribution = Sales × P/V ratio
= ₹ 60,000 × 25% = ₹ 15,000
Profit = Contribution – Fixed cost
= ₹ 15,000 – ₹ 12,000 = ₹ 3,000

(*b*) When sales = ₹ 1,00,000
Contribution = ₹ 1,00,000 × 25% = ₹ 25,000
Profit = ₹ 25,000 – ₹ 12,000 = ₹ 13,000.

Calculation of Sales for Desired Profits

Continuing the same figures, what will be the amount of sales if it is desired to earn a profit of (*a*) ₹ 6,000; (*b*) ₹ 15,000 ?

$$\text{Sales for desired profit} = \frac{\textit{Fixed cost} + \textit{Desired profit}}{\textit{P/V ratio}}$$

$$(a) = \frac{₹\ 12,000 + ₹\ 6,000}{25\%} = ₹\ 72,000$$

$$(b) = \frac{₹\ 12,000 + ₹\ 15,000}{25\%} = ₹\ 1,08,000.$$

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Calculation of Missing figures

Example :

Given: Break-even point = ₹ 30,000
Profit = ₹ 1,500
Fixed cost = ₹ 6,000

What is the amount of variable cost ?

Solution

$$\text{Contribution} = \text{Fixed cost} + \text{profit}$$
$$= ₹\ 6,000 + ₹\ 1,500 = ₹\ 7,500$$

$$\text{Break-even point} = \frac{\textit{Fixed cost}}{\textit{Contribution}} \times \textit{Sales}$$

$$₹\ 30,000 = \frac{6,000}{7,500} \times \textit{Sales}$$

$$\text{Sales} = \frac{6,000}{7,500} \times 30,000 = ₹\ 37,500$$

$$\text{P/V ratio} = \frac{\textit{Contribution}}{\textit{Sales}} \times 100 = \frac{7,500}{37,500} \times 100 = 20\%$$

Variable cost = 100 – P/V ratio
Variable cost = 100 – 20% = 80% (of sales)
∴ Variable cost (80% of sales) = ₹ 37,500 × 80% = ₹ 30,000
Variable cost at break-even sales = ₹ 30,000 × 80% = ₹ 24,000
Also, variable cost at Break-even sales = ₹ 30,000 – Fixed cost
= ₹ 30,000 – 6,000 = ₹ 24,000.

Example :

Sales = 4,000 units @ ₹ 10 per unit
Break-even point = 1,500 units
Fixed cost = ₹ 3,000

What is the amount of (*a*) variable cost; and (*b*) profit ?

Solution

$$\text{Break-even point (in units)} = \frac{\textit{Fixed cost}}{\textit{Contribution per unit}}$$

$$1,500 = \frac{₹\ 3,000}{\textit{Contribution per unit}}$$

$$\text{Contribution per unit} = \frac{₹\ 3,000}{1,500 \text{ units}} = ₹\ 2$$

(*a*) Variable cost = Selling price – Contribution
= ₹ 10 – ₹ 2 = ₹ 8 per unit
Contribution at sales of 4,000 units = 4000 units × ₹ 2 = ₹ 8,000
(*b*) Profit = *Contribution – Fixed cost*
= ₹ 8,000 – ₹ 3,000 = ₹ 5,000.

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Example :

Given:

Fixed cost	₹ 8,000
Profit earned	₹ 2,000
Break-even sales	₹ 40,000

What is the actual sales ?

Solution

Contribution at break-even point is equal to fixed cost.

$$\text{P/V ratio} = \frac{C}{S} = \frac{8,000}{40,000} = 20\%$$

Thus,

$$\text{Actual Sales} = \frac{\textit{Fixed cost} + \textit{Profit}}{\textit{P/V ratio}}$$

$$= \frac{8,000 + 2,000}{20\%} = \frac{10,000}{20\%} = ₹\ 50,000$$

Example :

Selling price – ₹ 150 per unit
Variable cost – ₹ 90 per unit
Fixed cost – ₹ 6,00,000 (total)

What is the break-even point?

What is the selling price per unit if break-even point is 12,000 units?

Thus,

$$\text{Break-even point} = \frac{\textit{Fixed cost}}{\textit{Contribution per unit}}$$

$$= \frac{6,00,000}{150-90} = \frac{6,00,000}{60} = 10,000 \text{ units.}$$

When break-even point is 12,000 units, contribution is calculated as under :

$$12,000 = \frac{6,00,000}{\textit{Contribution}}$$

$$\text{Contribution} = \frac{₹\ 6,00,000}{12,000 \text{ units}} = ₹\ 50$$

$$C = S - V$$
$$50 = S - 90$$
$$S = 50 + 90$$
$$S = ₹\ 140$$

Thus, selling price is ₹ 140 when break-even point is 12,000 units.

Illustration 5.3

The following information is given :

Sales	=	₹ 2,00,000
Variable cost	=	₹ 1,20,000
Fixed cost	=	₹ 30,000

Calculate (*a*) Break-even point
(*b*) New break-even point if selling price is reduced by 10%
(*c*) New break-even point if variable cost increases by 10%
(*d*) New break-even point if fixed cost increases by 10% *(B.Com. Madurai Kamaraj)*

Solution

$$\text{P/V ratio} = \frac{S-V}{S} = \frac{2,00,000-1,20,000}{2,00,000} = \frac{80,000}{2,00,000} \times 100 = 40\%$$

$$(a)\ \text{Break-even point} = \frac{F}{P/V\ ratio} = \frac{30,000}{40\%} = ₹\ 75,000$$

(*b*) When selling price in reduced by 10%, new sales = 2,00,000 − 10% = ₹ 1,80,000

$$\text{New P/V ratio} = \frac{1,80,000-1,20,000}{1,80,000} = \frac{60,000}{1,80,000} = \frac{1}{3}$$

$$\text{New Break-even point} = \frac{F}{P/V\ ratio} = \frac{30,000}{1/3} = ₹\ 90,000$$

(*c*) When variable cost increases by 10%, new variable cost
= 1,20,000 + 10% = ₹ 1,32,000

$$\text{New P/V ratio} = \frac{2,00,000-1,32,000}{2,00,000} = \frac{68,000}{2,00,000} \times 100 = 34\%$$

$$\text{New Break-even point} = \frac{30,000}{34\%} = ₹\ 88,235\ \text{(Approx).}$$

(*d*) If fixed cost increases by 10%, new fixed cost = 30,000 + 10% = ₹ 33,000
P/V ratio remains unaffected at 40%

$$\text{New Break-even point} = \frac{33,000}{40\%} = ₹\ 82,500.$$

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Illustration 5.4

From the following particulars, find out the selling price per unit if B.E. Point is to be brought down to 9,000 units :

Variable cost per unit	= ₹	75
Fixed expenses	= ₹	2,70,000
Selling price per unit	= ₹	100

(B.Com., Calicut)

Solution

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{Contribution per unit}}$$

$$9,000\ \text{units} = \frac{2,70,000}{\text{Contribution per unit}}$$

$$\text{Contribution per unit} = \frac{2,70,000}{9,000} = ₹\ 30.$$

At present the contribution is ₹ 25 (*i.e.*, 100 – 75). In order to bring B.E. Point at 9,000 units, contribution should be brought to ₹ 30. This means that selling price should be increased by ₹ 5. Thus, the new selling price should be ₹ 105.

Illustration 5.5

You are given the following data :

Fixed expenses ₹ 4,000
Break-even point ₹ 10,000

Calculate—

(*i*) P/V ratio
(*ii*) Profit when sales are ₹ 20,000
(*iii*) New break-even point if selling price is reduced by 20% *(B.Com., Delhi)*

Solution

At break-even point, contribution is equal to fixed cost thus when sales are ₹ 10,000, contribution = ₹ 4000.

(*i*) P/V ratio $\frac{C}{S} \times 100 = \frac{4,000}{10,000} \times 100 = \mathbf{40\%}$

(*ii*) When sales are ₹ 20,000, contribution will be—

20,000 × 40% = 8,000
Profit = Contribution – Fixed cost
= 8,000 – 4,000 = ₹ 4,000

(*iii*) New break-even point when selling price is reduced by 20%.

New sales figure = 20,000 – 20% = **₹ 16,000**
Variable cost = ₹ 12,000
Contribution = 16,000 – 12,000 = ₹ 4,000

$$\text{New P/V ratio} = \frac{C}{S} = \frac{4,000}{16,000} = 25\%$$

$$\text{New Break-even point} = \frac{F}{\text{P/V ratio}} = \frac{4,000}{25\%} = \mathbf{₹\ 16,000.}$$

Cash Break-even point

When break-even point is calculated only with those fixed costs which are payable in cash, such a break-even point is known as cash break-even point. This means that depreciation and other non-cash fixed costs are excluded from the fixed costs in computing cash break-even point. Its formula is —

$$\text{Cash break even point} = \frac{\text{Cash fixed costs}}{\text{Contribution per unit}}$$

MARGIN OF SAFETY (M/S)

Margin of safety may be defined as the difference between actual sales and sales at break-even point : In other words, it is the amount by which actual volume of sales exceeds the break-even

point. Margin of safety may be expressed in absolute money terms or as a percentage of sales. Thus,

$$M/S = \text{Actual sales} - \text{Break-even point}$$

Example :

	Company X	Company Y
Actual sales	₹ 1,20,000	60,000
Less : Break-even point	₹ 40,000	40,000
Margin of safety	₹ 80,000	20,000
Margin of safety as a % of sales	$= \frac{80,000}{1,20,000} \times 100$	$= \frac{20,000}{60,000} \times 100$
	$= 66\frac{2}{3}\%$	$= 33\frac{1}{3}\%$

The size of the margin of safety indicates soundness of a business. When margin of safety is large, it means the business can still make profits after a serious fall in sales. In such a situation, the business stands better chance of survival in times of depression. A large margin of safety usually indicates low fixed costs. When margin of safety is low, any loss of sales may be a matter of a serious concern.

Margin of safety is directly related to profit. This is shown below :

$$Profit = Margin\ of\ safety \times Profit/volume\ ratio$$
$$P = M/S \times P/V\ ratio$$

Thus
$$M/S = \frac{P}{P/V\ ratio}$$

If profit is 10% and P/V ratio is 40%, then

$$M/S = \frac{10\%}{40\%} = 25\%$$

When actual sales are given—

$$Profit = M/S\ ratio \times P/V\ ratio \times Actual\ sales$$

When profit is not known but *M/S* is known, then

$$P = M/S \times P/V\ ratio$$
$$P = 25\% \times 40\% = 10\%$$

Also M/S in units $= \frac{Profit}{Contribution\ per\ unit}$

When margin of safety is not satisfactory, the following steps may be taken to improve it : (*a*) Increase the volume of sales, (*b*) Increase the selling price, (*c*) Reduce fixed cost, (*d*) Reduce variable cost, (*e*) Improve sales mix by increasing the sales of products with larger P/V ratio.

The effect of a price reduction is always to reduce P/V ratio, raise the break-even point and shorten the margin of safety.

This is illustrated below :

Example :
Fixed cost ₹ 10,000, Variable cost ₹ 50 per unit. Actual sales ₹ 75,000. Suppose price is reduced from ₹ 75 to ₹ 60

	Before price reduction	After price reduction
	₹	₹
Selling price per unit (*S*)	75	60
Variable cost per unit (*V*)	50	50
Total fixed cost (*F*)	10,000	10,000
Contribution (*S* – *V*)	25	10
P/V ratio $\left(\frac{F}{P/V\ ratio}\right)$	$\frac{25}{75}=\frac{1}{3}$	$\frac{10}{60}=\frac{1}{6}$
Break-even point	$=\frac{10,000}{1/3}$	$\frac{10,000}{1/6}$
	= 30,000	= 60,000
Actual sales	75,000	75,000
M/S (Actual sales – B.E. Point)	75,000 – 30,000	75,000 – 60,000
	= 45,000	= 15,000

Thus by reducing price from ₹ 75 to ₹ 60, P/v ratio has reduced from 1/3 to 1/6, break even point has gone up from ₹ 30,000 to ₹ 60,000 and M/s has come down from ₹ 45,000 to ₹ 15,000.

Illustration 5.6

Calculate margin of safety in each of the following independent situations.

(*i*) Break even point 40%, Actual sales ₹ 40,000
(*ii*) Actual sales – 40,000 units, Break-even point 25,000 units
(*iii*) Break-even point – 75%
(*iv*) P/V ratio 40%, Profit ₹ 35,000
(*v*) Contribution per unit ₹ 20, Profit ₹ 15,000

Solution

(*i*) Margin of safety = Actual sales – BE Point
= ₹ 40,000 – 40% = **₹ 24,000**

(*ii*) Margin of safety = Actual sales – BE point
= 40,000 units – 25,000 units = **₹ 15,000 units**

(*iii*) Margin of safety = 100 – BE Point = 100 – 75% = **25%**

(*iv*) Margin of safety = $\frac{\text{Profit}}{\text{P/V ratio}} = \frac{35000}{40\%}$ = **₹ 87,500**

(*v*) Margin of safety = $\frac{\text{Profit}}{\text{p/v ratio}} = \frac{\text{Rs. 15,000}}{\text{Rs. 20}}$ = **750 units**

Illustration 5.7

The profit/volume ratio of Escorts Ltd. is 50% and the margin of safety is 40%. You are required to workout the net profit and the break-even point if sales volume is ₹ 10,00,000.

Solution

	₹
Sales	10,00,000
Less: Margin of safety (40% of sales)	4,00,000
Break-even point	6,00,000

Contribution = Sales × P/V ratio

Contribution at B.E. Point = 6,00,000 × 50% = ₹ 3,00,000

At break-even point, the entire amount of contribution is fixed cost since there is no profit at this point.

Thus, fixed cost = ₹ 3,00,000.

Profit = Contribution – Fixed cost

Contribution on sales of ₹ 10,00,000 = 10,00,000 × 50%

= ₹ 5,00,000

Profit = 5,00,000 – 3,00,000 = ₹ 2,00,000

These calculations can be verified as follows :

Profit % = M/S × P/V

= 40% × 50% = 20% of sales

Profit = 10,00,000 × 20% = ₹ 2,00,000.

Illustration 5.8

Calculate break-even point in each of the following independent situations :

(*i*) Fixed cost ₹ 10,000; P/V ratio 50%

(*ii*) Fixed cost ₹ 15,000; Contribution ₹ 3 per unit.

(*iii*) Margin of safety – 20%

(*iv*) Fixed cost ₹ 9,000, Variable cost to sales ratio = 60%

(*v*) Actual sales ₹ 50,000, Margin of safety 30%

(*vi*) Profit ₹ 30,000, Margin of safety 20%, Variable cost is 70% of sales.

(*vii*) Margin of safety ₹ 70,000, Actual sales ₹ 4,00,000.

(*viii*) Actual sales 10,000 units, Margin of safety 2,500 units

Solution

(*i*) BE Point = $\frac{\text{Fixed cost}}{\text{P / V ratio}} = \frac{₹\ 10,000}{50\%}$ = **₹ 20,000**

(*ii*) BE Point = $\frac{\text{Fixed cost}}{\text{Contribution per unit}} = \frac{₹\ 15,000}{₹\ 3}$ = **5,000 units**

(*iii*) BE Point = 100 – Margin of safety in % = 100 – 20 = **80% of sales**

(*iv*) P/V ratio = 100 – 60% = 40%

BE Point = $\frac{\text{Fixed cost}}{\text{P / V ratio}} = \frac{9,000}{40\%}$ = **₹ 22,500**

(*v*) BE Point = Actual sales – Margin of safety

= ₹ 50,000 – 30% = **₹ 35,000**

(vi) P/V ratio = 100 – 70% = 30%

$$\text{Margin of safety} = \frac{\text{Profit}}{\text{P / V ratio}} = \frac{₹\ 30,000}{30\%} = ₹\ 1,00,000$$

$$\text{Actual sales} = \frac{\text{Margin of safety}}{\text{Margin of safety\%}} = \frac{₹\ 1,00,000}{20\%} = ₹\ 5,00,000$$

BE Point = Actual sales – Margin of safety
= 5,00,000 – 1,00,000 = **₹ 4,00,000**

Verification

Profit = Actual sales × M/s ratio × P/V ratio
₹ 30,000 = 5,00,000 × 20% × 30%

(vii) BE Point = Actual sales – Margin of safety
= ₹ 4,00,000 – 70,000 = **₹ 3,30,000**

(viii) BE Point = Actual sales – Margin of safety
= 10,000 units – 2,500 units = **7,500 units**

Illustration 5.9

Calculate contribution in each of the following independent situations :

(i) Margin of safety ₹ 15,000; Fixed cost ₹ 25,000; P/V ratio 30%. Also calculate profit in this case.

(ii) BE Point ₹ 40,000; P/V ratio 40%; Profit ₹ 10,000.

(iii) Margin of safety 40%; Profit ₹ 30,000.

(iv) P/V ratio 40%; Profit ₹ 50,000; BE Point ₹ 1,00,000.

(v) Margin of safety 4,000 units; contribution ₹ 3 per unit; Fixed cost ₹ 30,000.

Solution

(i) Contribution = (M/s in ₹ × P/V ratio) + Fixed cost
= (₹ 15,000 × 30%) + 25,000 = **₹ 29,500**
Profit = M/S × P/V ratio = ₹ 15,000 × 30% = **₹ 4,500**
or Profit = C – F = ₹ 29,500 – 25,000 = ₹ 4,500

(ii) Contribution = (BE Point × P/V ratio) + Profit
= (40,000 × 40%) + 10,000 = **₹ 26,000**

(iii) Contribution = $\frac{\text{Profit}}{\text{Margin of safety in\%}} = \frac{₹\ 30,000}{40\%} =$ **₹ 75,000**

(iv) Contribution = (BE Point × P/V ratio) + Profit
= (₹ 1,00,000 × 40%) + ₹ 50,000 = **₹ 90,000**

(v) Contribution = (Margin of safety in units × Contribution per unit) + Fixed cost
= (4000 units × ₹ 3) + ₹ 30,000 = **₹ 42,000**

Illustration 5.10

Calculate profit in each of the following independent cases

(i) Fixed cost ₹ 37,000; Contribution ₹ 84,000.

(ii) Variable cost 80% of sales, Margin of safety ratio 30%, Sales ₹ 1,00,000.

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(*iii*) Fixed cost ₹ 2,00,000; Margin of safety 50%, P/V ratio 40%

(*iv*) Margin of safety ₹ 70,000, Variable cost ratio to sales 35%

(*v*) Actual sales ₹ 80,000; P/V ratio 20%, Fixed cost ₹ 10,000.

Solution

(*i*) Contribution = Fixed cost + Profit

84,000 = 37,000 + Profit

Profit = 84,000 – 37,000 = **₹ 47,000**

(*ii*) P/V ratio = 100 – 80% = 20%

Profit = Sales × M/S ratio × P/V ratio

= 1,00,000 × 30% × 20% = **₹ 6,000**

(*iii*) BE Point $= \frac{\text{Fixed cost}}{\text{P / V ratio}} = \frac{2,00,000}{40\%}$ = ₹ 5,00,000

$$\text{Margin of safety ratio} = \frac{\text{Margin of safety}}{\text{Actual sales}} = \frac{\text{Margin of safety}}{\text{BE Point + Margin of safety}}$$

Suppose Margin of safety = x

$$x\% = \frac{x}{5,00,000 + x}$$

$$50\% = \frac{x}{5,00,000 + x}$$

$x = 0.50\ (5,00,000 + x)$

$= 2,50,000 + 0.5x$

$x - 0.5x = 2,50,000$

x = ₹ 5,00,000

Thus margin of safety = ₹ 5,00,000

Profit = Margin of safety × P/V ratio

= 5,00,000 × 40% = **₹ 2,00,000**

Verification

Actual sales = BE Point + Margin of safety

= 5,00,000 + 5,00,000 = ₹ 10,00,000

Profit = Actual sales × M/S ratio × P/V ratio

= 10,00,000 × 50% × 40% = **₹ 2,00,000**

(*iv*) P/V ratio = 100 – 35% = 65%

Profit = Margin of safety × P/V ratio

= 70,000 × 65% = **₹ 45,500**

(*v*) Profit = Contribution – Fixed cost

= (Actual sales × P/V ratio) – Fixed cost

= (80,000 × 20%) – 10,000 = **₹ 6,000**

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Illustration 5.11

Short Questions

(i) Margin of safety 60%, Fixed cost ₹ 2,10,000, Variable cost ratio to sales 70%. Determine the amount of actual sales.

(ii) BE Point ₹ 40,000, Fixed cost ₹ 15,000. What is the P/V ratio ?

(iii) Fixed cost ₹ 12,000, Actual sales ₹ 48,000, Margin of safety ₹ 8,000. What is the P/V ratio ?

(iv) Find out the BE Point when P/V ratio 40%, Margin of safety 30%, Profit ₹ 12,000.

(v) Break-even point occurs at 60% of capacity sales and P/V ratio is 30%. What is the amount of capacity sales when fixed cost is ₹ 1,80,000. Also find the amount of profit at 72% of capacity sales.

(vi) What is the amount of margin of safety when profit is ₹ 50,000 contribution ₹ 70,000 and sales ₹ 7,00,000. Also determine the break even point.

(vii) Calculate the amount of actual sales when profit ₹ 20,000, break-even point ₹ 50,000 and fixed cost ₹ 25,000.

(viii) Variable cost is 80% of sales and margin of safety is 40%. What is the amount of fixed cost if sales are ₹ 2,00,000.

Solution

(i) P/V ratio = 100 – 70% = 30%

$$\text{BE Point} = \frac{\text{Fixed cost}}{\text{P / V ratio}} = \frac{2,10,000}{30\%} = ₹\ 7,00,000$$

$$\text{Sales} = \frac{\text{BE Point in ₹}}{100 - \text{M/S\%}} = \frac{7,00,000}{100 - 60\%} = \frac{7,00,000}{40\%} = \textbf{₹ 17,50,000}$$

Verification

BE Point = Actual sales – M/S
= 17,50,000 – 60% = ₹ 7,00,000

(ii) $\text{BE Point} = \frac{\text{Fixed cost}}{\text{P / V Ratio}}$

$$\therefore \text{P/V ratio} = \frac{\text{Fixed cost}}{\text{B.E. Point}} = \frac{15,000}{40,000} \times 100 = \textbf{37.50\%}$$

(iii) BE Point = Actual sales – Margin of safety
= 48,000 – 8,000 = ₹ 40,000

$$\text{P/V ratio} = \frac{\text{Fixed cost}}{\text{BE. Point}} = \frac{12,000}{40,000} \times 100 = \textbf{30\%}$$

(iv) Profit = Actual sales × Margin of safety % × P/V ratio

$$\therefore \text{Actual sales} = \frac{\text{Profit}}{\text{M / S ratio} \times \text{P / V ratio}} = \frac{12,000}{40\% \times 30\%} = ₹\ 1,00,000$$

BE Point = Actual Sales – Margin of safety
= 1,00,000 – 30% = **₹ 70,000**

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(v) BE Point $= \frac{\text{Fixed cost}}{\text{P / V ratio}} = \frac{1,80,000}{30\%} = ₹\ 6,00,000$

Capacity sales $= \frac{₹\ 6,00,000}{60\%} = ₹\ 10,00,000$

Sales at 72% of capacity = 10,00,000 × 72% = ₹ 7,20,000

Profit = (Sales × P/V ratio) − Fixed cost

= (7,20,000 × 30%) − 1,80,000 = **₹ 36,000**

(vi) P/V ratio $= \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{70,000}{7,00,000} \times 100 = 10\%$

Margin of safety $= \frac{\text{Profit}}{\text{P / V ratio}} = \frac{50,000}{10\%} = ₹\ 5,00,000$

Fixed cost = Contribution − Profit

= ₹ 70,000 − 50,000 = ₹ 20,000

BE Point $= \frac{\text{Fixed cost}}{\text{P / V ratio}} = \frac{20,000}{10\%} = ₹\ 2,00,000$

(vii) P/V ratio $= \frac{\text{Fixed cost}}{\text{BE Point}} = \frac{25,000}{50,000} = 50\%$

Sales $= \frac{\text{Fixed cost + Profit}}{\text{P / V ratio}} = \frac{25,000 + 20,000}{50\%} = ₹\ 90,000$

(viii) P/V ratio = 100 − 80% = 20%

Break even sales = ₹ 2,00,000 − 40% = ₹ 1,20,000

BE Point $= \frac{\text{Fixed cost}}{\text{P / V ratio}}$

Fixed cost = Break-even Point × P/V ratio

= ₹ 1,20,000 × 20% = **₹ 24,000**

LIMITING OR KEY FACTOR

The objective of a business is to earn maximum profit. However, it is not always easy to achieve this objective because profit earning is affected by a variety of factors. For example, an undertaking may have sufficient orders on hand, ample skilled labour and production capacity, but may be unable to obtain all the quantity of material it needs for the manufacture of maximum quantities which could be sold. Thus, material is the factor which *limits* the size of output and prevents an undertaking from maximising its profit. Similarly, sometimes a business is not able to sell all that it can produce. In such a case, sales is the limiting factor.

A limiting or key factor may thus be defined as the *factor in the activities of an undertaking, which at a particular point in time or over a period will limit the volume of output.* Examples of limiting factors are :

(i) Sales
(ii) Materials
(iii) Labour of particular skill
(iv) Production capacity or machine hours
(v) Financial resources.

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The purpose of the limiting factor technique is to indicate the most profitable course of action in all such cases where alternatives are possible.

Contribution per unit of key factor—When a key factor is operating, the most profitable position is reached when contribution per unit of key factor is maximum. For instance, if a choice lies between producing product *A* which yields a contribution of ₹ 15 per unit and product *B* which yields a contribution of ₹ 20 per unit, product *B* would be more profitable.

If, however, product *A* takes 3 kg., of material (which is a limiting factor) and product *B* takes 5 kg., the respective contributions per kg. of material would be :

Product *A* = ₹ 15 ÷ 3 kg. = ₹ 5

Product *B* = ₹ 20 ÷ 5 kg. = ₹ 4

Product A, which gives the greater contribution in terms of per unit of limiting factor will be more profitable.

Illustration 5.12

The following data at is given :

	Product A	*Product B*
Direct materials	₹ 24	14
Direct labour @ ₹ 3 per hour	₹ 6	9
Variable overhead @ ₹ 4 per hour	₹ 8	12
Selling price	₹ 100	110
Standard time	2 hrs.	3 hrs.

State which product you would recommend to manufacture when :

(*a*) Labour time is the key factor

(*b*) Sales value is the key factor.

Solution

	Product A	*Product B*
	₹	₹
Selling price (*S*)	100	110
Direct material	24	14
Direct labour	6	9
Variable overhead	8	12
Variable cost (*V*)	38	35
Contribution (*S* – *V*)	62	75
(*a*) Contribution per labour hour	₹ 62 ÷ 2 hrs. = ₹ 31	₹ 75 ÷ 3 hrs. = ₹ 25
(*b*) Contribution per rupee of sales value	= ₹ 62 ÷ 100 = 62 paise	= ₹ 75 ÷ 110 = 68 paise

Conclusion

(*a*) Product *A* is recommended when labour time is the key factor because contribution per labour hour of product A is more than that of product *B*.

(*b*) When sales value is the key factor, product *B* is recommended because contribution per rupee of sales value of product *B* is more than that of product *A*.

(*c*) When sale quantity is the key factor, product *B* is more profitable because its contribution per unit is higher than that of product *A*.

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ANGLE OF INCIDENCE

This angle is formed by the intersection of sales line and total cost line at the break-even point (see Fig. 5.1). This angle shows the rate at which profits are being earned once the break-even point has been reached. The wider the angle, the greater is the rate of earning profits. Therefore, the aim of management will be to have as large an angle as possible.

The angle of incidence is of particular importance in boom periods when sales are expanding. Taking in conjunction with margin of safety, therefore, a large angle of incidence with a high margin of safety indicates and extremely favourable position.

COST INDIFFERENCE POINT

Cost indifference point refers to that level of output where the total cost or the profit of the two alternatives are equal. Such a level may be calculated where two or more alternative methods of production or machines are considered and the use of one machine involves higher fixed cost and lower variable cost per unit while the other machine involves lower fixed cost and higher variable cost per unit. The calculation of point of cost indifference helps in a cost minimisation or exercise and identifies the alternative which is more profitable for a given level of output or sales. A machine with a lower fixed cost and a higher variable cost per unit is more profitable when actual sales are below the point of cost indifference and vice versa, a machine with a higher fixed cost and a lower variable cost per unit is more profitable when actual sales are more than the point of cost indifference. The formula for calculation is as follows :

$$\text{Cost indifference point (in units)} = \frac{\text{Difference in fixed cost}}{\text{Difference in contribution per unit}}$$

$$\text{Cost indifference point (in ₹)} = \frac{\text{Difference in fixed cost}}{\text{Difference in P / V ratio}}$$

Illustration 5.13

GMR Co. Ltd. has to choose between machine X_1 and X_2 and provides the following data :

	X_1	X_2
Output per annum (units)	10,000	10,000
Profit at the above level ₹	30,000	24,000
Fixed cost per annum ₹	30,000	16,000

Compute :

(*i*) B.E. Point of the two machines.

(*ii*) Level of output where the two machines are equally profitable

(*iii*) The machine suitable for different levels of output of the product.

Solution

Contribution = Fixed cost + Profit.

Machine A = 30,000 + 30,000 = ₹ 60,000

Machine B = 16,000 + 24,000 = ₹ 40,000

C or contribution per unit – A = ₹ 60,000 ÷ 10,000 units = ₹ 6

– B = ₹ 40,000 ÷ 10,000 units = ₹ 4

(*i*) Break-even point = FC ÷ C

A = ₹ 30,000 ÷ ₹ 6 = 5,000 units

B = ₹ 16,000 ÷ ₹ 4 = 4,000 units

(ii) $$\text{Cost indifference point} = \frac{\text{Difference in FC}}{\text{Difference in C}}$$

$$= \frac{30,000 - 16,000}{6 - 4} = \frac{14,000}{2} = 7,000 \text{ units}$$

At 7,000 units, both the machines will produce the same amount of profit.

(iii) Machine B will be more profitable between break-even point and point of cost indifference *i.e.*, between 4,000 units and 7,000 units.

A is more profitable when sales one more than 7,000 units.

GRAPHIC PRESENTATION OF BREAK-EVEN ANALYSIS

Break-even Chart

Break-even chart is a graphic presentation of break-even analysis. This chart takes its name from the fact that the point at which the total cost line and the sales line intersect is the break-even point. A break-even chart not only shows the break-even point but also shows profit and loss at various levels of activity.

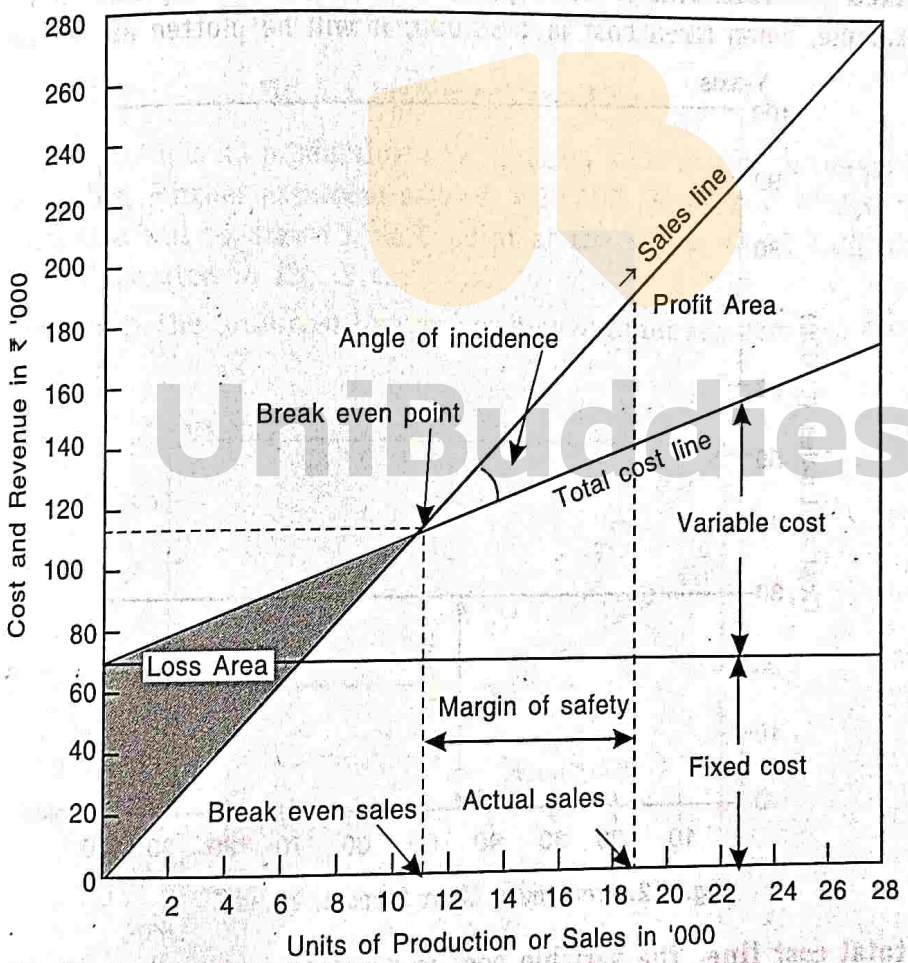

Fig. 5.1. Break-even Chart

Thus a break-even chart portrays the following information :

(i) Break-even point – the point at which neither profit nor loss is made.
(ii) The profit/loss at different levels of output.
(iii) The relationship between variable cost, fixed cost and total cost.

(iv) The margin of safety.
(v) The angle of incidence, indicating the rate at which profit is being made.
(vi) The amount of contribution at various levels of sales. (This can be shown only on a specially designed 'contribution break-even chart.')

Construction of Break-even Chart

The principal steps in the construction of a break-even chart are as follows :

1. **Select a scale on X-axis.** The X-axis is a horizontal base line which is drawn and spaced into equal distances to represent any one or more of the following factors:
   (i) Volume of output (units)
   (ii) Volume of output (in rupee value)
   (iii) Volume of sales (units)
   (iv) Volume of sales (in rupee value)
   (v) Production capacity (in percentage)

2. **Select scale on Y-axis.** The Y-axis is a vertical line at the extreme left of the chart which is spaced into equal distances. On this Y-axis, it is usual to show cost and sales in rupee value.

3. **Draw the fixed cost line.** This is drawn parallel to X-axis, starting from an appropriate point on Y-axis. For example, when fixed cost is ₹ 30,000, it will be plotted as is shown in Fig. 5.2.

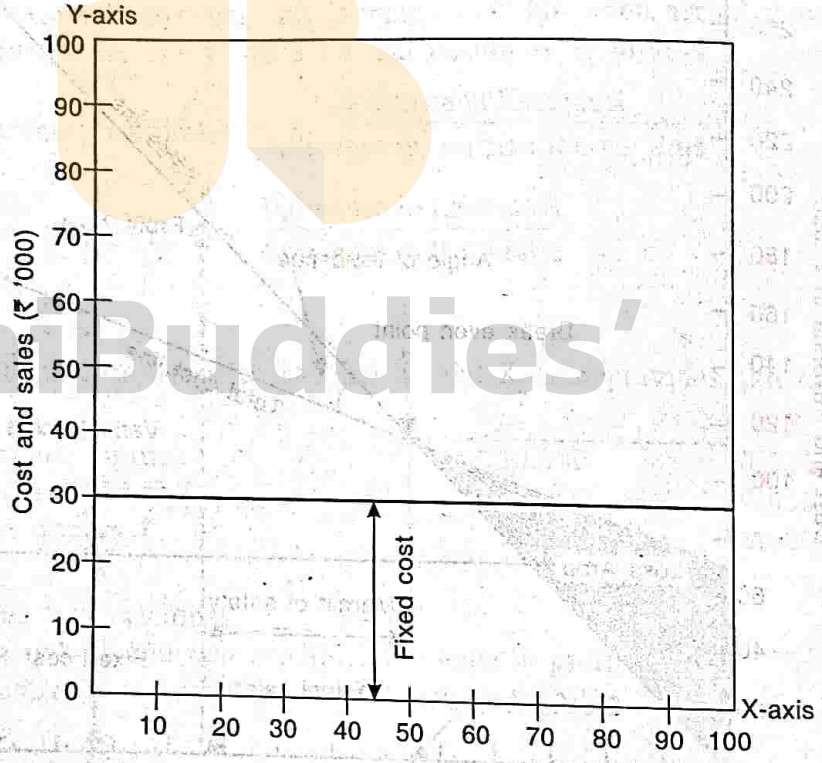

Fig. 5.2. Break-even Chart Steps 1, 2 and 3

4. **Draw the total cost line.** The variable cost is depicted in the chart by super-imposing it on the fixed cost line. Thus a total cost line is drawn starting from the point on the *Y*-axis which represents fixed cost. For example, when total variable cost is ₹ 50,000 (fixed cost being ₹ 30,000), a total cost line is drawn from ₹ 30,000, the fixed cost point of Y-axis, to the ₹ 80,000 cost point on the right side of the Y-axis. This is shown below in Fig. 5.3.

5. **Draw the sales line.** This line starts from the 0 point at the left (the intersection of X-

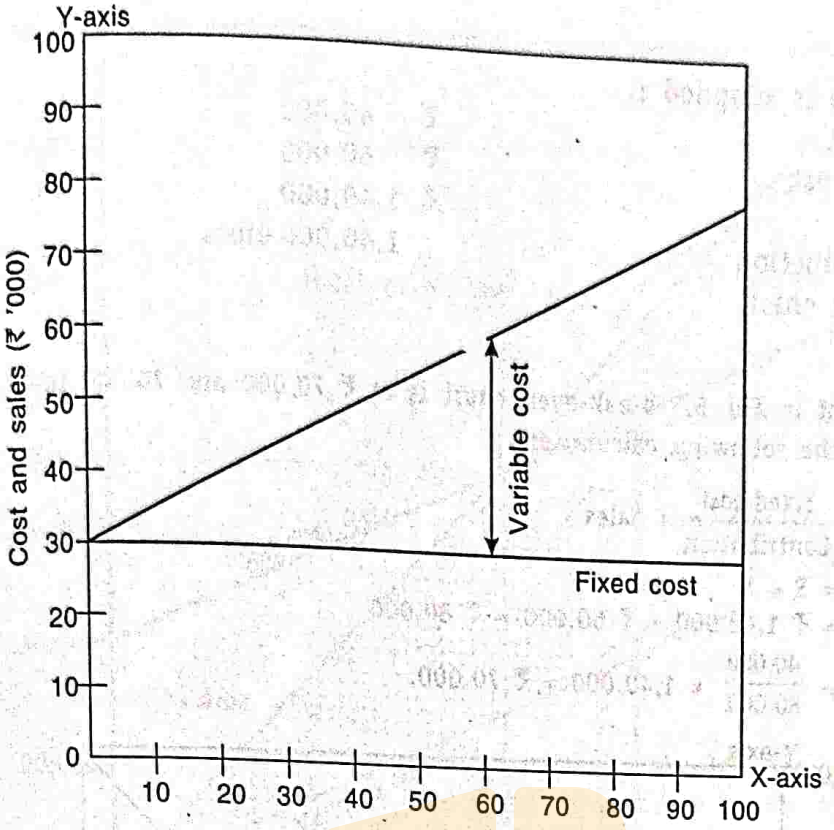

Fig. 5.3. Break-even Chart Steps 4

axis and Y-axis, where there is no production at a nil cost) and extends to the point of maximum or any other sales value. Further assuming sales ₹ 1,00,000 (Fixed cost ₹ 30,000, variable cost ₹ 50,000), the sales line will be drawn from 0 point at the left to the ₹ 1,00,000 point on the right Y-axis. This is illustrated in Fig. 5.4.

The sales line intersects the total cost line at break-even point representing ₹ 60,000 sales and output.

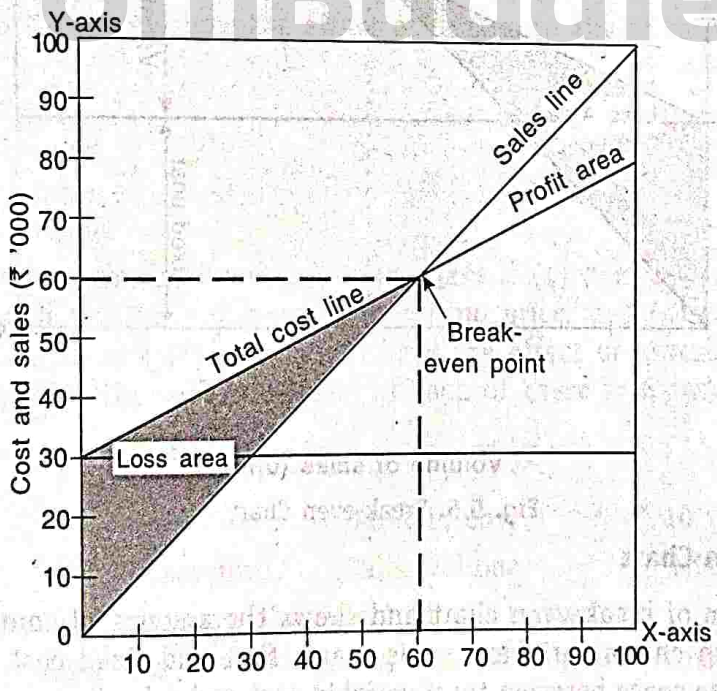

Fig. 5.4. Break-even Chart Steps 5

Example

The following data is supplied :

Fixed cost	₹ 40,000
Variable cost	₹ 60,000
Sales	₹ 1,40,000
Sales/production	1,40,000 units

Draw a break-even chart.

Solution

The break-even point in Fig. 5.5 break-even chart is at ₹ 70,000 and 70,000 units This is verified by the following calculations :

Break-even point $= \frac{\text{Fixed cost}}{\text{Contribution}} \times \text{Sales}$

Contribution $= S - V$

$= ₹\ 1,40,000 - ₹\ 60,000 = ₹\ 80,000$

Break-even point $= \frac{40,000}{80,000} \times 1,40,000 = ₹\ 70,000.$

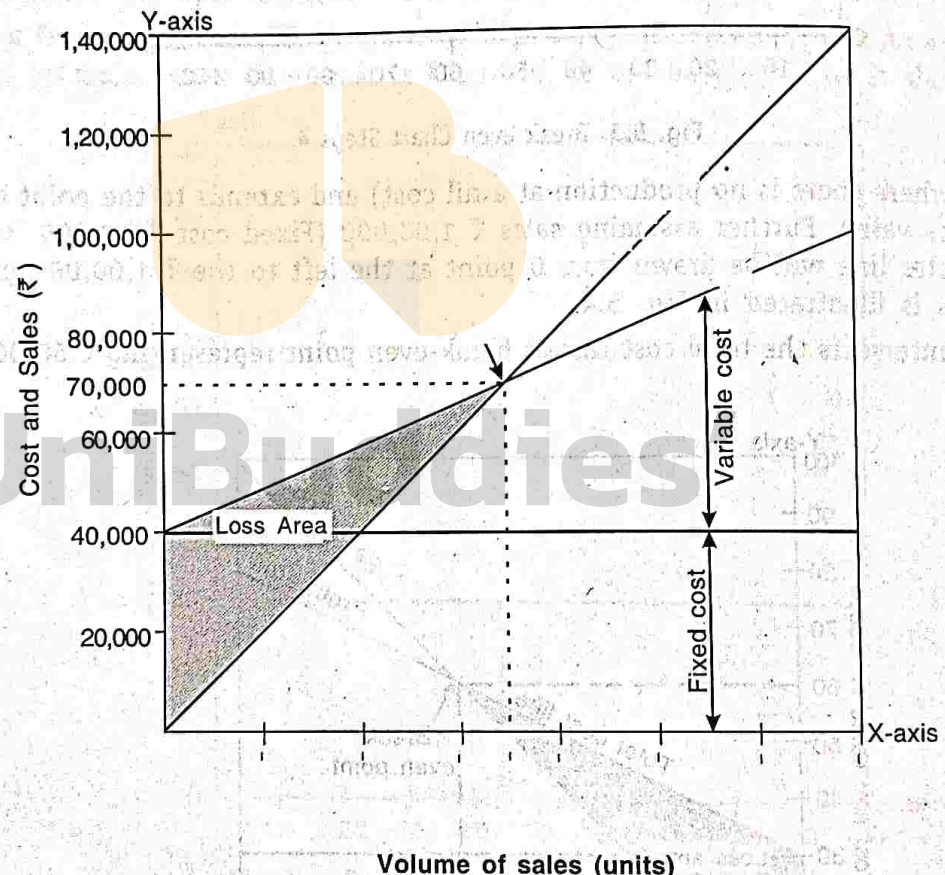

Fig. 5.5. Break-even Chart

Contribution Break-even Chart

This is an alternate form of break-even chart and shows the amount of contribution at different levels of output. In such charts variable cost is drawn first and fixed cost is super-imposed on the variable cost line. The space between total variable cost and sales line represents contribution. This is now shown in Fig. 5.6 with the figures of the above example.

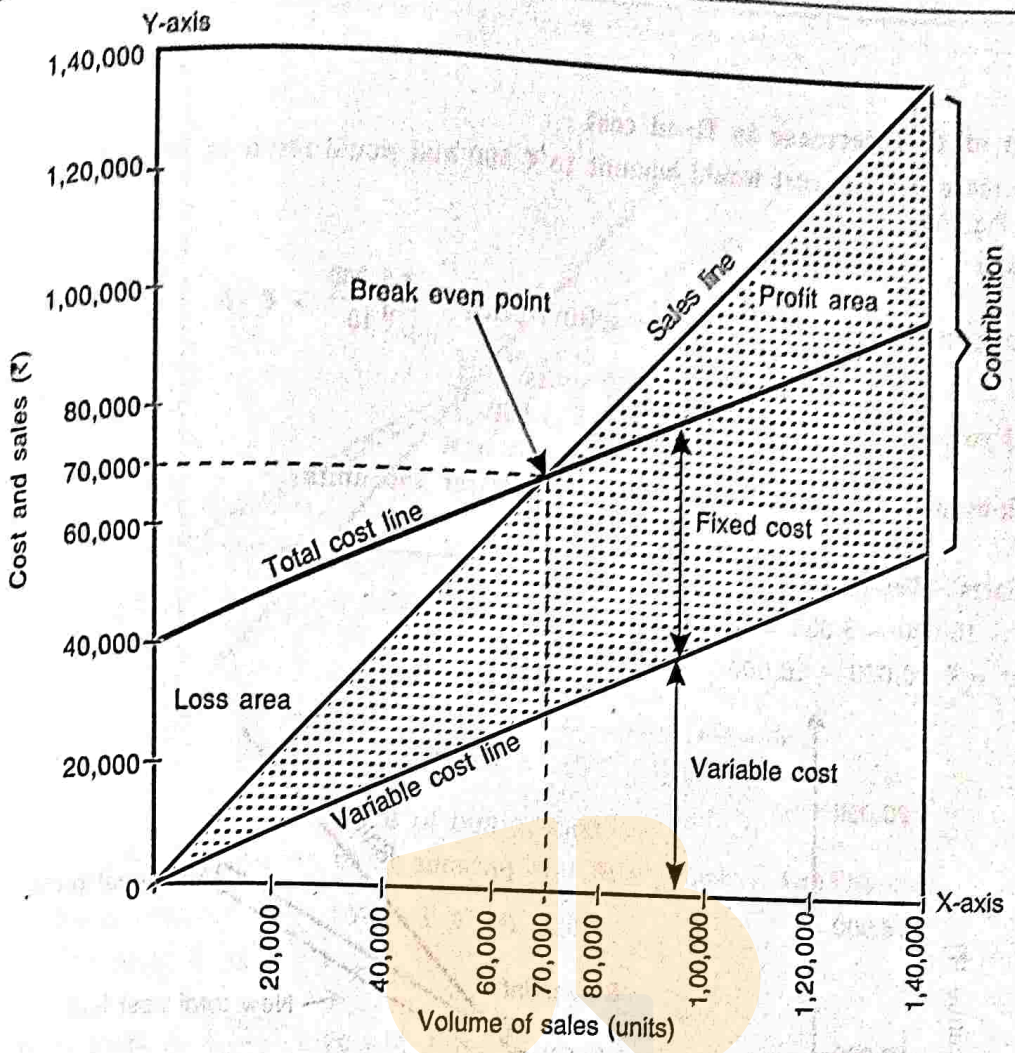

Fig. 5.6. Contribution Break-even Chart

EFFECT OF CHANGE IN THE PROFIT FACTORS

The break-even chart can also show the effect of change in any of the following factors, which affect profit :

(*a*) Change in fixed cost
(*b*) Change in variable cost
(*c*) Change in selling price
(*d*) Change in sales volume.

The profit of a business can be increased when there is (*a*) decrease in fixed cost, and/or (*b*) decrease in variable cost, and/or (*c*) increase in selling price, and (*d*) increase in sales volume. The fist three, *i.e.*, (*a*), (*b*) and (*c*) factors will have the effect of lowering the break-even point and thus increasing profit. The separate effect of each of these is shown in the following charts and calculations :

Illustration 5.14

Fixed cost	₹ 5,000	Variable cost	₹ 10 per unit
Selling price	₹ 20 per unit	Sales volume	1,000 units

Draw a break-even chart and show the effect of the following :

(*a*) 10% decrease in fixed cost
(*b*) 10% decrease in variable cost
(*c*) 10% increase in selling price
(*d*) 10% increase in sales volume.

Solution

(a) Effect of 10% decrease in fixed cost

A 10% decrease in fixed cost would amount to ₹ 500 and would result in 10% increase in profits. This is shown in Fig. 5.8

Calculations

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{Contribution}} \times \text{selling price} = \frac{₹\,5,000}{₹\,10} \times ₹\,20$$

= ₹ 10,000 or 500 units

New Fixed cost = ₹ 5,000 – 10% = ₹ 4,500

$$\text{New Break-even point} = \frac{₹\,4500}{₹\,10} \times 20 = ₹\,9,000 \text{ or } 450 \text{ units}$$

Profit = Sales – Variable cost – Fixed cost

₹ 20,000 – 10,000 – 5,000 = ₹ 5,000

New profit = ₹ 20,000 – 10,000 – 4,500 = ₹ 5,500

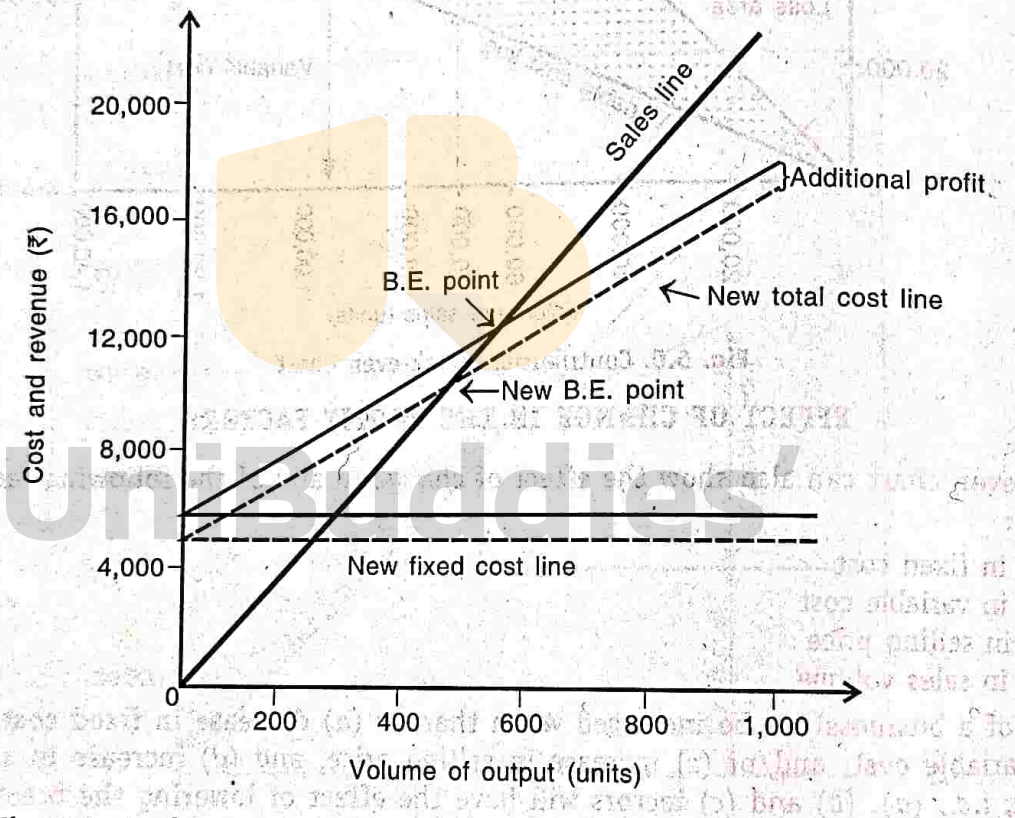

Fig. 5.8 Break-even chart showing the effect of 10% decrease in fixed cost

(b) Effect of 10% decrease in variable cost

A 10% decrease in variable cost would amount to ₹ 1,000 at the present level of output and it would increase profit by 20%. This is depicted on Fig. 5.9.

Calculations

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{Contribution}} \times \text{Selling price}$$

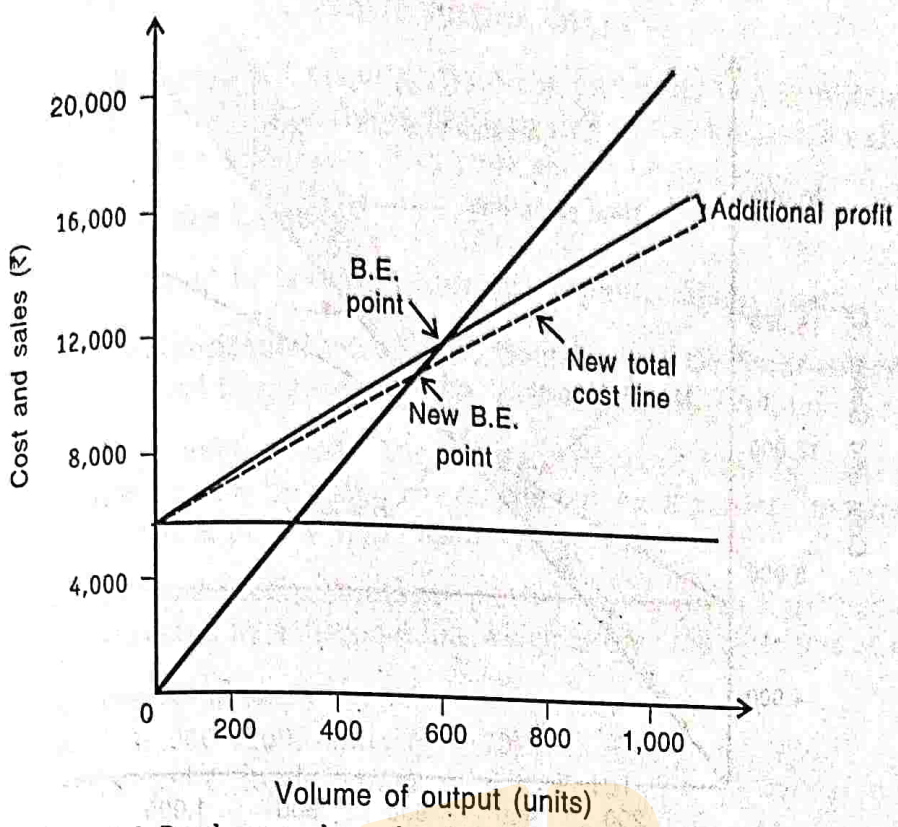

Fig. 5.9 Break-even chart showing of 10% decrease in variable cost.

New variable cost = ₹ 10 – 10% = ₹ 9 per unit

New contribution ₹ 20 – ₹ 9 = ₹ 11

$$\text{New Break-even point} = \frac{₹\,5000}{₹\,11} \times 20 = ₹\ 9{,}091 \text{ (Approx.)}$$

New profit = ₹ 20,000 – ₹ 9,000 – ₹ 5,000 = ₹ 6,000.

(c) Effect of 10% increase in selling price

A 10% increase in selling price would add ₹ 2,000 to sales revenue and would increase the current profit by 40%. This is shown on Fig. 5.10.

Calculations

New sales figures = 20,000 + 10% = ₹ 22,000

New contribution per unit = 22 – 10 = ₹ 12

$$\text{New break-even point} = \frac{5000}{12} \times 22 = ₹\ 9{,}167 \text{ (Approx.)}$$

$$= 417 \text{ units (Approx.)}$$

New profit = ₹ 22,000 – 10,000 – 5,000 = ₹ 7,000

(d) Effect of 10% increase in sales volume

A 10% increase in sales volume would increase profit by ₹ 1000 (*i.e.*, at the rate of contribution of ₹ 10 per unit for 100 unit). Increase in sales volume will have no effect on the break-even point. (See Fig. 5.11)

Calculations

New sales figure	= 1100 units × ₹ 20	= ₹ 22,000
New Variable cost	= 1100 units × ₹ 10	= ₹ 11,000
New profit	= 22000 – 11000 – 5000	= ₹ 6,000

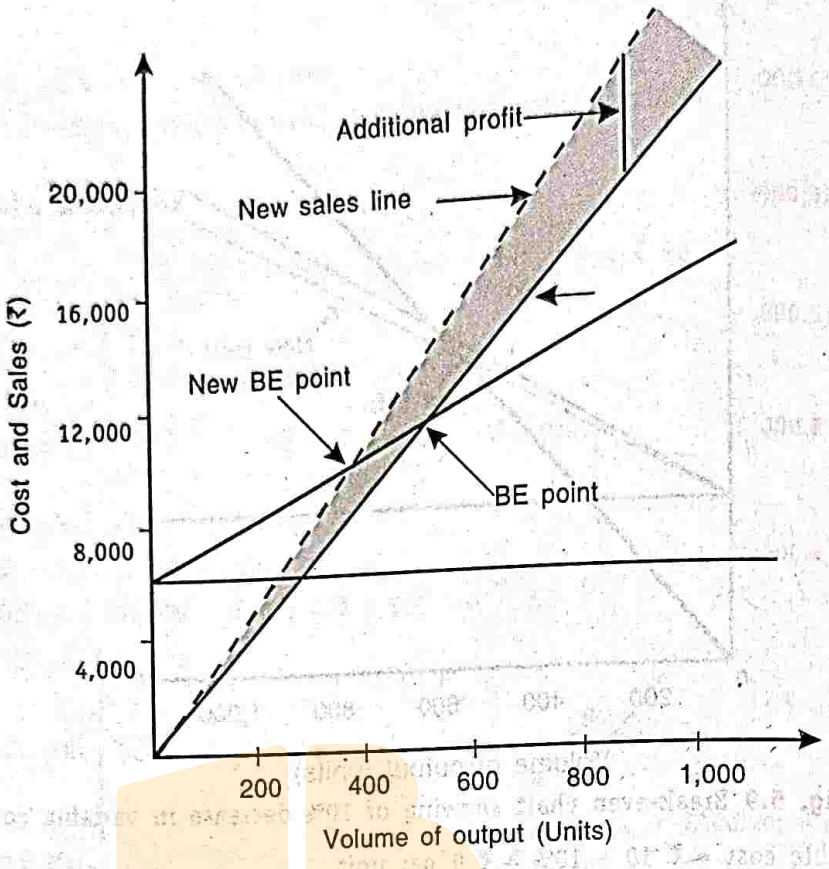

Fig. 5.10 Break-even chart showing the effect of 10% increase in selling price

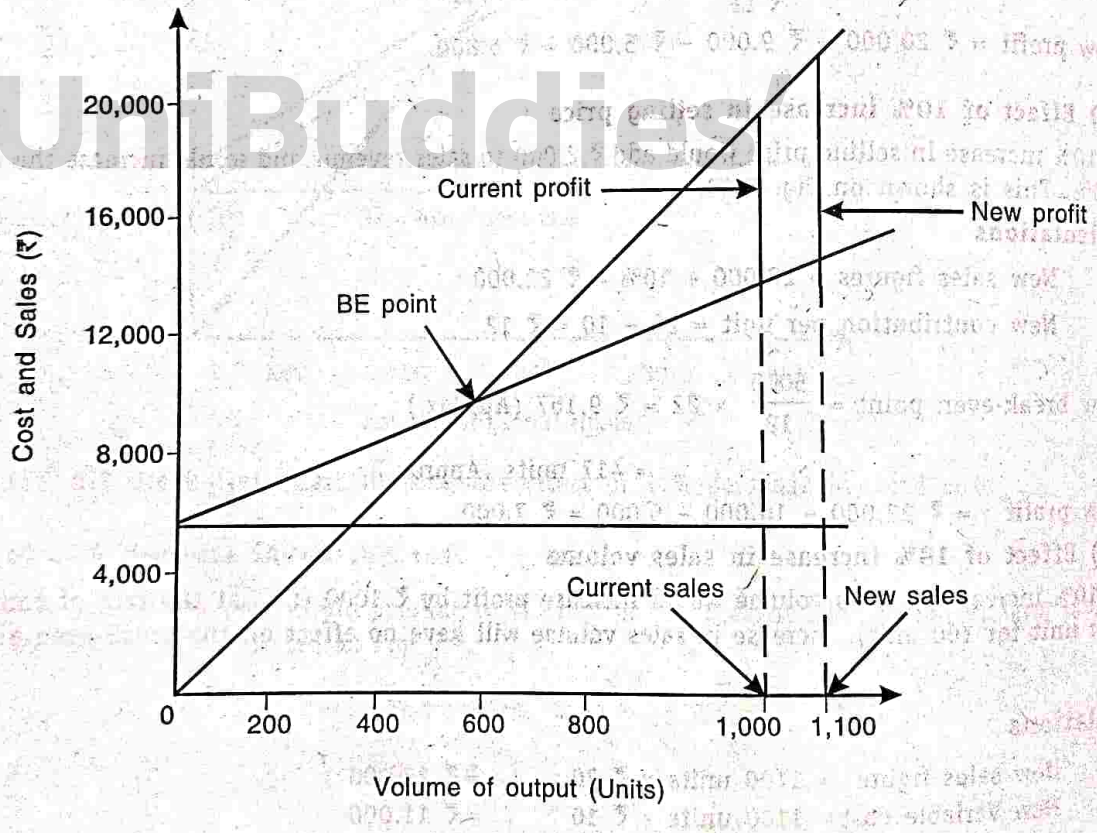

Fig. 5.11 Break-even chart showing the effect of 10% increase in sales volume

PROFIT-VOLUME CHART

The profit-volume chart or profit graph portrays the profit and loss at different levels of sales and is an alternative presentation of the facts illustrated in the break-even chart. Such a chart can be constructed from the same basic data from which a break-even chart can be drawn.

Construction of Profit-Volume Chart

The following steps should be taken to construct a profit-volume chart.

1. **Select a scale on horizontal axis.** The horizontal axis in the profit-volume graph represents sales. This horizontal line, known as sales line, divides the graph into two parts.
2. **Select a scale on vertical axis.** The vertical axis shows fixed cost and profit. The fixed costs are market below the sales line on the left hand vertical line and profit is shown above the sales line on the right hand vertical line.
3. **Plot fixed cost and profit.** Points are plotted for the given fixed cost and profit. These points are connected by a diagonal line which crosses the sales line at break-even point.

Example: Fixed cost ₹ 5,000
Sales ₹ 20,000 (1000 units @ ₹ 20)
Variable cost ₹ 10,000 (1000 units @ ₹ 10)

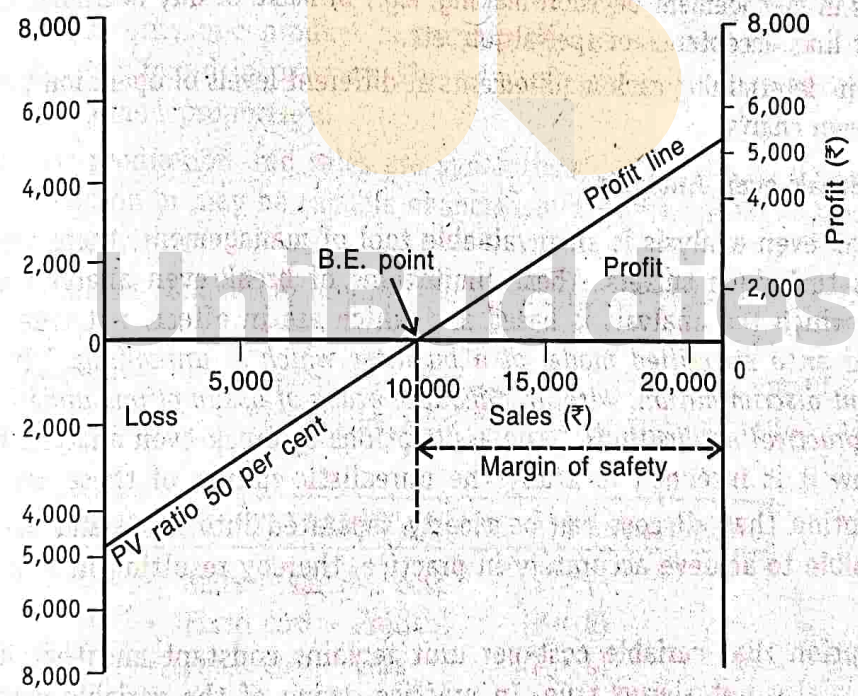

Fig. 5.12. Profit-volume Chart

Calculations

$$\text{Profit-Volume ratio} = \frac{S - V}{S} = \frac{20{,}000 - 10{,}000}{20{,}000} \times 100 = 50\%$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{₹\ 5,000}{50\%} = ₹\ 10,000$$

Profits = $S - F - V$ = 20,000 - 5,000 - 10,000 = ₹ 5,000

Uses of Break-even Analysis

Some of the important uses of break-even analysis are summarised below :

1. It help in determining the break-even point.
2. It help in determining the selling price which will give the desired profit.
3. It help in determining the sales volume to earn a desired profit or return on capital employed.
4. It help in determining the costs and revenue at different levels of output.
5. It help in determining the most profitable sales mix.
6. It help in determining comparative profitability of each product line.
7. It studies the effect of change in selling price or of price differentiation in different markets, *e.g.*, home market and foreign market.
8. It studies the impact of increase or decrease in fixed and variable costs on profits.
9. It studies the effect on profits and break-even points of high proportion of variable costs with low fixed cost and vice-versa.
10. It compares the profitability of various firms.
11. It helps in management decision-making, *e.g.*, in make or buy decisions, discontinuance of a product line, acceptance of special job, etc.
12. It help in determining cash requirements at different levels of operation with the help of cash break-even charts.

Limitations of Break-even Analysis

Although break-even analysis is an invaluable tool of management, there are some limitations from which this technique suffers. These limitations of break-even analysis arise from certain assumptions on which the analysis is based and which are in effect, not true. Thus *"break-even analysis is based on a simplified model of a business which is unrealistic."* It *"must be applied with an intelligent discrimination, with an adequate grasp of assumptions underlying the technique surrounding its practical applications."* The assumptions of break-even analysis have already been narrated and now it is intended to study the unrealistic nature of these assumptions.

1. The assumption that all cost can be clearly separated into fixed and variable components is not possible to achieve accurately in practice, thereby resulting in inaccurate break-even analysis.
2. The assumption that variable cost per unit remains constant and that it gives a straight line chart is also not always true. In practice, many of the variable costs do not observe this tendency. Most of the variable costs, no doubt, move in sympathy with the volume of production but not necessarily in direct proportion to the volume.
3. Similarly, the assumption that fixed cost remains constant is also unrealistic. Fixed costs are constant only within a limited range of output and tend to increase by a sudden jump when additional plant and machinery is introduced.
4. The assumption regarding selling prices remaining unchanged as volume changes is also not true. In practice, selling prices do not remain fixed and change in prices affects demand.

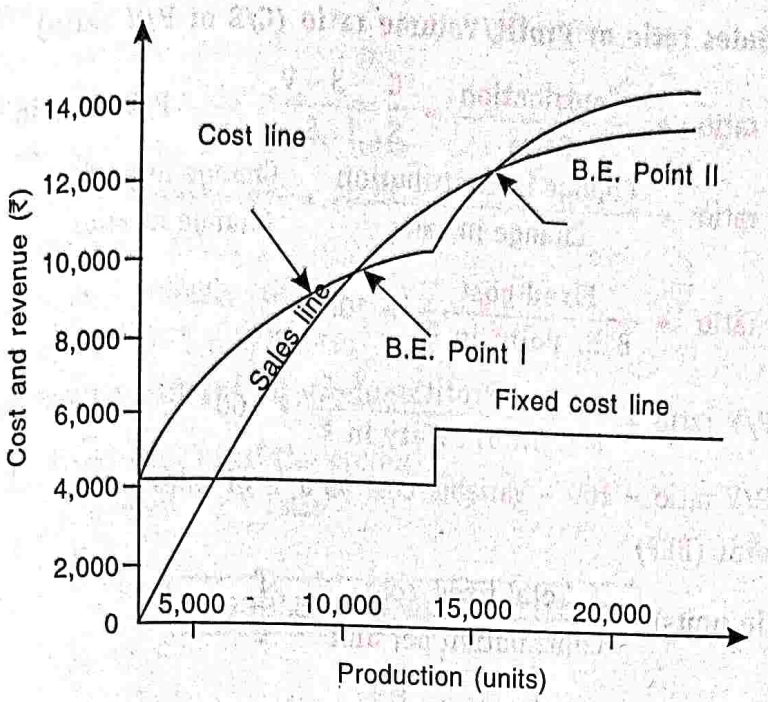

Fig. 5.13. Break-even chart with more than one break-even point showing that cost and sales lines in actual practice cannot be represented by straight lines.

Any increase in output can be sold only by effecting a reduction in selling price which would effect the sales line.

5. The assumption that only one product is being produced or that product mix will remain unchanged is also not found in practice. The sales of various products manufactured is not always in predetermined proportion.

6. It is assumed that production and sales are synchronised. This is not always so. Sales may fall short of production or may be capable of increase to match production only by effecting a reduction in selling prices.

7. The break-even analysis completely ignores the consideration of capital employed which may be an important factor in the study of profit analysis.

In spite of these limitations, break-even analysis is a very useful management device. It should be used by keeping in mind its limitations because then alone the technique can be used more effectively.

SUMMARY OF FORMULAE AND ABBREVIATIONS

1. **Contribution** (C) = Sales – Variable cost (S – V)
   or (C) = Fixed cost + Profit (F + P)
   or (C) = Fixed cost – Loss (F – L)
   Thus S – V = F + P
   or S – V = F – L
   Also Contribution = Sales in ₹ × P/V ratio
   or Contribution = (Sales at BEP in ₹ × P/V ratio) + Profit
   or Contribution = (Sales at BEP in units × Contribution per unit) + Profit
   or Contribution = (Margin of Safety in ₹ × P/V ratio) + Fixed cost
   or Contribution = (Margin of Safety in units × C per unit) + Fixed cost

   or $\text{Contribution} = \frac{\text{Profit}}{\text{Margin of safety in\%}}$

2. Contribution/Sales ratio or Profit/Volume ratio (C/S or P/V ratio)

$$\text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{C}{S} = \frac{S - V}{S} \qquad \text{P/V ratio in \%} = \frac{C}{S} \times 100$$

$$\text{Also,} \quad \text{P/V ratio} = \frac{\text{Change in contribution}}{\text{Change in sales}} = \frac{\text{Change in profit}}{\text{Change in sales}}$$

$$\text{P/V ratio} = \frac{\text{Fixed cost}}{\text{B.E. Point in ₹}} \times 100$$

$$\text{P/V ratio} = \frac{\text{Profit}}{\text{Margin of safety in ₹}} \times 100$$

$$\text{P/V ratio} = 100 - \text{Variable cost as a \% of sales}$$

3. Break-even point (BEP)

$$\text{BEP (in units)} = \frac{\text{Total fixed cost}}{\text{Contribution per unit}} = \frac{F}{C}$$

$$\text{BEP (in ₹)} = \frac{F}{P/V \text{ ratio}} = \frac{F}{C} \times S$$

$$\text{BEP} = \text{Actual sales} - \text{Margin of safety}$$

4. Calculation of sales to earn a given profit

$$\text{(in units)} = \frac{F + \text{Profit}}{C \text{ (per unit)}} \qquad \text{(in ₹)} = \frac{F + \text{Profit}}{P/V \text{ ratio}}$$

5. Cost indifference point $= \dfrac{\text{Difference in fixed cost}}{\text{Difference in P/V ratio or contribution per unit}}$

6. Margin of Safety (M/S) = Actual sales – Break-even point

$$\text{M/S ratio} = \frac{\text{Actual sales} - \text{BEP}}{\text{Actual sales}} \times 100$$

OR

$$\text{Margin of safety in \% of sales} = \frac{\text{Margin of safety}}{\text{Actual sales}} \times 100$$

$$= 100 - \text{B.E. Sales in \%}$$

$$\text{M/S} = \frac{\text{Profit}}{P/V \text{ ratio}}$$

$$\text{Profit} = \text{Margin of safety} \times \text{P/V ratio.}$$

$$\text{Profit} = \text{Actual sales} \times \text{M/S ratio} \times \text{P/V ratio.}$$

7. Break even sales in % $= \dfrac{\text{B.E. Point}}{\text{Total sales}} \times 100$

or $= 100 - \text{Margin of safety in \%}$

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8. **Profit** = Sales – Total cost
   or = Sales – Variable cost – Fixed cost
   or = Contribution – Fixed cost
   or = Margin of safety in ₹ × P/V ratio

9. **Fixed Cost** = Sales – Variable cost – Profit
   or = Contribution – Profit
   = Total cost – Variable cost
   = Sales at BEP in ₹ × P/V ratio

10. **Overall Break even point (of all products)**

$$= \frac{\text{Total fixed cost of all the products}}{\text{Overall P / V ratio}}$$

PROBLEMS AND SOLUTIONS

Problem 5.1

A company produces single product which sells for ₹ 20 per unit. Veriable cost is ₹ 15 per unit and fixed overhead for the year is ₹ 6,30,000.

Required:

(a) Calculate sales value needed to earn a profit of 10% on sales.

(b) Calculate sales price per unit to bring BEP down to 1,20,000 units.

(c) Calculate margin of safety sales if profit is ₹ 60,000.

Solution :

(a) Suppose No. of units of sale = x

Total sales = $20x$, Variable cost $15x$

Total sales = Variable cost + Fixed cost + Profit

$\therefore \quad 20x = 15x + 6,30,000 + 2x$

$20x - 17x = 6,30,000$

$x = 6,30,000/3 = 2,10,000$ units.

Sales value = 2,10,000 units × ₹ 20 = **₹ 42,00,000**

(b) Present B.E. Point $= \frac{F}{C} = \frac{₹\ 6,30,000}{₹\ 20 - 15} = 1,26,000$ units.

Required B.E. Point = 1,20,000 units.

$\therefore \quad BEP = \frac{F}{C}$

$1,20,000 = \frac{₹\ 6,30,000}{C}$

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Contribution or C = $\frac{₹\ 6,30,000}{1,20,000 \text{ units}}$ = ₹ 5.25

New selling price = Variable cost + Contribution

= ₹ 15 + 5.25 = ₹ 20.25 = **₹ 20.25**

(c) P/V ratio = $\frac{C}{S} = \frac{5}{20}$ = 25%

Margin of safety sales = $\frac{\text{Profit}}{\text{P/V ratio}} = \frac{60,000}{25\%}$ = ₹ 2,40,000

Problem 5.2

From the following data calculate the break-even point.

Direct material per unit	₹ 3
Direct labour per unit	₹ 2
Fixed overhead (Total)	₹ 10,000
Variable overhead	100% on direct labour
Selling price per unit	₹ 10
Trade discount	5%

Also determine the net profits, if sales are 10% above the break-even point. *(B.Com., C.A. Inter)*

Solution

Marginal Cost Statement

	₹
Net selling price (₹ 10 – 5% discount)	9.50
Direct material	3.00
Direct labour	2.00
Variable Overhead	2.00
Variable cost	7.00
Contribution (₹ 9.50 – 7.00)	2.50

Break-even point = $\frac{F}{C} = \frac{10,000}{2.50}$ 4,000 units

B.E. Point (in ₹) = 4,000 units @ ₹ 10	= ₹ 40,000
Less : 5% discount	2,000
Net sales value at B.E. Point	₹ 38,000
When sales are 10% above B.E. Point	
Sales = 4,000 + 10% = 4,400 units	
Contribution (4,400 units × ₹ 2.50)	₹ 11,000
Less : Fixed cost	₹ 10,000
Profit	₹ 1,000

Problem 5.3

Electro Company sold 10,000 units last year at a price of ₹ 500 each. The cost structure per unit is as follows :

			₹
Materials		...	100
Labour		...	50
Variable overheads		...	25
	Variable cost	...	175
Fixed overheads		...	200
	Total cost	...	375

Due to competition, the price has to be reduced to ₹ 425 for the coming year. Assuming that there will be no change in costs, find out how many units shall be sold to ensure the same amount of total profit as last year. *(B.Com. Delhi)*

Solution

Statement of Marginal Cost and Contribution

		Per unit ₹	*Total (10,000 units)* ₹
(A)	Sales	500	50,00,000
	Materials	100	10,00,000
	Labour	50	5,00,000
	Variable overheads	25	2,50,000
(B)	Variable cost	175	17,50,000
	Contribution *(A – B)*	325	32,50,000
Less:	Fixed overheads	200	20,00,000
	Profit	125	12,50,000

Contribution at new selling price = New SP – VC

= ₹ 425 – ₹ 175 = ₹ 250.

$$\text{Sales to earn a desired profit} = \frac{\text{Fixed cost + Desired profit}}{\text{Contribution per unit}}$$

Sales to earn a profit of ₹ 12,50,000 at reduced selling price

$$= \frac{20,00,000 + 12,50,000}{250} = \textbf{13,000 Units}$$

Thus if selling price is reduced to ₹ 425 per unit, then 13,000 radios will have to be sold to earn the same profit.

Verification

	New sales (13,000 × 425)	= 55,25,000
Less :	Variable cost (13,000 × 175)	= 22,75,000
	Contribution	= 32,50,000
Less:	Fixed cost	= 20,00,000
	Profit	= 12,50,000

Problem 5.4

The following data is given :

	₹
Selling price	20 per unit
Variable manufacturing costs	11 per unit
Variable selling costs	3 per unit
Fixed factory overheads	5,40,000 per year
Fixed selling costs	2,52,000 per year

You are required to compute :

(*i*) Break-even point expressed in amount of sales in rupees;

(*ii*) Number of units that must be sold to earn a profit of ₹ 60,000 per year.

(*iii*) How many units must be sold to earn a net income of 10% of sales? *(B.Com., Hons. Delhi)*

Solution

$$\text{P/V ratio} = \frac{S - V}{S} = \frac{20 - 14}{20} = \frac{6}{20} = 30\%$$

(*i*) $$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{5,40,000 + 2,52,000}{30\%}$$

$$= \frac{\text{Rs. } 7,92,000}{30\%} = \textbf{₹ 26,40,000}$$

(*ii*) Units to be sold to earn a profit of ₹ 60,000

$$= \frac{\text{Fixed cost + desired profit}}{\text{Contribution per unit}} = \frac{7,92,000 + 60,000}{6} = \textbf{1,42,000 units}$$

Contribution = S − V = 20 − 14 = ₹ 6

(*iii*) Suppose units to be sole to earn 10% profit = '*x*'

Total sales = Selling price × units = 20 *x*

Total sales = Variable cost + Fixed cost + Profit

$$20x = 14x + 7,92,000 + 2x$$

Thus $$4x = 7,92,000$$

$$x = 7,92,000 \div 4$$

$$x = 1,98,000$$

Thus sales to earn a net income of 10% on sales = **1,98,000 units.**

Problem 5.5

Fill in the blanks for each of the following independent situations:

	A	*B*	*C*	*D*	*E*
Selling price per unit ₹	–	50	20	–	30
variable cost as % of sales	60	–	75	75	–
No. of units sold	10,000	4,000	–	6,000	5,000
Contribution	₹ 20,000	80,000	–	25,000	50,000
Fixed cost	₹ 12,000	–	1,20,000	10,000	–
Profit (Loss) ₹	–	20,000	30,000	–	15,000

(C.A. Inter)

Solution

Situation A

Profit = Contribution – Fixed cost
= 20,000 – 12,000 = ₹ **8,000**

Suppose selling price = x

No. of units sold (S.P. per unit – Variable cost per unit) = Contribution

$$10{,}000\left(x-\frac{3}{5}x\right) = ₹\ 20{,}000$$

$$\frac{2}{5}x = ₹\ 2$$

$$x = ₹\ 5$$

Thus selling price per unit = ₹ **5**

Situation B

Fixed cost = Contribution – Profit
= 80,000 – 20,000 = ₹ 60,000

Contribution p.u. = ₹ 80,000 ÷ 4000 units = ₹ 20

$$\text{Variable cost as a \% of sales} = \frac{\text{S.P.} - \text{Contribution per unit}}{\text{S.P.}}$$

$$= \frac{50-20}{50} \times 100 = 60\%$$

Situation C

Contribution = F + P = 1,20,000 + 30,000 = ₹ 1,50,000

P/V ratio = 100% – 75% = 25%

Contribution per unit = ₹ 20 × 25% = ₹ 5

$$\text{No. of units sold} = \frac{\text{Total contribution}}{\text{Contribution per unit}} = \frac{₹\ 1{,}50{,}000}{₹\ 5} = 30{,}000 \text{ units}$$

Situation D

Profit = C – F = ₹ 25,000 – 10,000 = ₹ 15,000

P/V ratio = 100% – 75% = 25%

$$\text{Sales} = \frac{F+P}{P/V \text{ ratio}} = \frac{25{,}000}{25\%} = ₹\ 1{,}00{,}000$$

Selling price per unit = ₹ 1,00,000 ÷ 6000 units = ₹ 16.67

Situation E

Fixed cost = C – P = 50,000 – 15,000 = ₹ 35,000

$$\text{Total Sales} = \frac{C}{S} = \frac{50{,}000}{1{,}50{,}000} \times 100 = 33.33\%$$

Variable cost as a % of Sales = 100% – 33.33% = 66.67%

Problem 5.6

(*a*) A company has fixed expenses of ₹ 90,000 with sales at ₹ 3,00,000 and a profit of ₹ 60,000. Calculate the Profit/Volume ratio. If in the next period the company suffered a loss of ₹ 30,000, calculate the sales volume.

(*b*) What is the margin of safety for a profit of ₹ 60,000 in (*a*) above? (*C.A. Inter*)

UniBuddies'

Solution

(*a*) Contribution = Fixed cost + Profit = ₹ 90,000 + 60,000 = ₹ 1,50,000

$$\text{P/V ratio} = \frac{C}{S} \times 100 = \frac{1,50,000}{3,00,000} \times 10 = \mathbf{50\%}$$

In the next period Contribution = Fixed cost – Loss = ₹ 90,000 – 30,000 = ₹ 60,000

$$\text{P/V ratio} = \frac{60,000}{\text{Sales}} = 50\%$$

$$\text{Sales} = \frac{60,000}{50\%} = \mathbf{₹\ 1,20,000}$$

Thus at sales of ₹ 1,20,000, there will be a loss of ₹ 30,000.

(*b*) Margin of safety $= \frac{\text{Profit}}{\text{P/V ratio}} = \frac{60,000}{50\%} = \mathbf{₹\ 1,20,000}$

or M/S = Sales – Break-even point

$$= 3,00,000 - \left(\frac{\text{Fixed cost}}{\text{P/V ratio}}\right) = 3,00,000 - \left(\frac{90,000}{50\%}\right) = ₹\ 1,20,000.$$

Problem 5.7

A Company has a P/V ratio of 40%. By what percentage must sales be increased to off-set:

(*a*) 10% reduction in selling price.

(*b*) 20% reduction in selling price

(B.Com. Hons. Delhi)

Solution

Suppose —	Sales = (100 units @ ₹ 1 each)	₹ 100
	Less : Contribution (40% of sales)	40
	Variable cost	60

When selling price is reduced by 10%, then–

New Sales	₹ 90
Less : Variable cost	60
New contribution	30

Volume of sales to maintain the same contribution will be

$$= \frac{\text{Contibution}}{\text{New contribution}} \times \text{New sales} = \frac{40}{30} \times 90 = ₹\ 120$$

Thus if the selling price is reduced by 10%, the volume of sales will have to be increased by 20%, *i.e.*, from ₹ 100 to ₹ 120.

(*b*) If Selling price is reduced by 20%

New sales	₹ 80
Less: Variable cost	₹ 60
New contribution	₹ 20

In order to maintain the same contribution, the volume of sales should be:

$$\frac{40}{20} \times 80 = ₹\ 160$$

Thus if selling price is reduced by 20%, the sales will have to be increased by 60%.

Problem 5.8

The variable cost structure of a product manufactured by a company during the current year is as under :

	₹ per unit
Material	120
Labour	30
Overheads	12

The selling price per unit is ₹ 270 and the fixed cost and sales during the current year are ₹ 14 lakhs and ₹ 40.50 lakhs respectively.

During the forthcoming year, the direct workers will be entitled to a wage increase of 10% from the beginning of the year and the material cost, variable overhead and fixed overhead are expected to increase by 7.5%, 5% and 3% respectively.

The following are required to be computed :

(a) New sale price in the forthcoming year if the current P/V ratio is to be maintained.

(b) Number of units that would require to be sold during the forthcoming year, so as to yield the same amount of profit in the current year, assuming that selling price per unit will not be increased.

(I.C.W.A., Inter)

Solution

Marginal Cost Statement

	Current year	*Increase*	*Next year*
	₹		₹
Material	120	7.5%	129
Labour	30	10%	33
Variable overhead	12	5%	12.60
Variable cost per unit	162		174.60
Selling price	270		
Contribution (S – V)	108		

$$\text{P/V ratio} = \frac{C}{S} \times 100 = \frac{108}{270} \times 100 = 40\%$$

(a) **New selling price for the forthcoming year**—The current year's marginal cost is 60% of the selling price of ₹ 270. In order to maintain the current *P/V* ratio of 40% in the forthcoming year, the new selling price should be :

$$\frac{174.60}{60\%} = ₹\ 291$$

(b) **Sales volume in the forthcoming year**

	₹
Profit in the current year :	
Contribution (40% of ₹ 40.50 lakhs)	16,20,000
Less : Fixed cost	14,00,000
Profit	2,20,000
Forthcoming year:	
Profit required	2,20,000
Add: Fixed cost (14,00,000 + 3%)	14,42,000
Desired contribution	16,62,000

Contribution per unit = 270 – 174.60 = 95.40

UniBuddies'

Volume of sales required = $\frac{16,62,000}{95.40}$ = ₹ 17,421 units (Approx).

Problem 5.9

ABC Ltd. manufatures three products *P*, *Q* and *R*. The unit selling prices of these products are ₹ 100, ₹ 80 and ₹ 50 respectively. The corresponding unit variable costs are ₹ 50, ₹ 40 and ₹ 20. The proportions (quantity-wise) in which these products are manufactured and sold are 20%, 30% and 50% respectively. The total fixed costs are ₹ 14,80,000.

Given the above information, you are required to work out the over-all break-even quantity and the product-wise break-up of such quantity. *(B.Com. Hons., Delhi)*

Solution

One of the assumptions of break-even analysis is that the company produces only one product and in case of multi-product companies, product mix does not change. In the present problem, three products *P*, *Q* and *R* are being manufactured, the total contribution from the three products is taken as a contribution of one composite unit. Thus:

	Sales – Variable cost	= Contribution
P	= ₹ 100 – 50	= ₹ 50
Q	= ₹ 80 – 40	= ₹ 40
R	= ₹ 50 – 20	= ₹ 30

Contribution per composite unit:

P	= 50 × 20 %	= 10
Q	= 40 × 30 %	= 12
R	= 30 × 50 %	= 15
		₹ 37

Overall break-even point = $\frac{\text{Fixed cost}}{\text{Contribution}} = \frac{14,80,000}{37}$ = 40,000 units

Break-even point of *P* = 40,000 × 20% = **8,000 units**

Break-even point of *Q* = 40,000 × 30% = **12,000 units**

Break-even point of *R* = 40,000 × 50% = **20,000 units**

Problem 5.10

Sultan Plastic Company makes plastic buckets. An analysis of their accounting reveals:

Variable cost per bucket	₹ 20
Fixed cost	₹ 50,000 for the year
Capacity	2,000 buckets per year
Selling price per bucket	₹ 70

Required :

(*i*) Find the break-even point.

(*ii*) Find the number of buckets to be sold to get a profit of ₹ 30,000.

(*iii*) If the company can manufacture 600 buckets more per year with an additional fixed cost of ₹ 2,000, what should be the selling price to maintain the profit per bucket as at (*ii*) above.

(B.Com. Hons. Delhi)

Solution

Contribution = Selling Price – Variable cost
= ₹ 70 – ₹ 20 = ₹ 50 per bucket

(i) **B.E. Point (units)** = $\frac{\text{Fixed cost}}{\text{Contribution per unit}} = \frac{₹\ 50,000}{₹\ 50} = 1,000$ units

(ii) **Required Sales** = $\frac{\text{Fixed cost + Desired profit}}{\text{Contribution per unit}} = \frac{₹\ 50,000 + 30,000}{₹\ 50} = 1,600$ units

Profit per bucket = ₹ 30,000 ÷ 1600 buckets = **₹ 18.75**

(iii) **Sales** = V.C. + F.C. + Profit

The company can now produce 2,000 + 600 = 2,600 buckets

∴ (2,600 × SP) = (2,600 × ₹ 20) + ₹ 52,000 + (2,600 × 18.75)
= 52,000 + 52,000 + 48,750 = ₹ 1,52,750

Selling price per unit (SP) = $\frac{₹\ 1,52,750}{2,600 \text{ buckets}} = ₹\ 58.75$

Verification

		Per unit ₹	*Total* ₹
	Sales	58.75	1,52,750
Less :	Variable cost	20.00	52,000
	Contribution	38.75	1,00,750
Less :	Fixed cost	20.00	52,000
	Profit	18.75	48,750

Problem 5.11

A, B and *C* are three similar plants under the same management who want them to be merged for better operation. The details are as under :

Plant	*A*	*B*	*C*
Capacity operated	100%	70%	50%
	₹ (in lakhs)	₹ (in lakhs)	₹ (in lakhs)
Turnover	300	280	150
Variable cost	200	210	75
Fixed cost	70	50	62

Find out :

(i) the capacity of the merged plant for break-even.

(ii) the profit at 75% capacity of the merged plant.

(iii) the turnover from the merged plant to give a profit of ₹ 28 lakhs.

(B.Com. Hons. Delhi, C.A. Inter)

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Solution

Statement of Cost and Turnover of the Three Plants at 100% capacity.

(Figures in lakhs)

	Plants			
Capacity	A 100%	B 100%	C 100%	Merged Plant 100%
Turnover	300	400	300	1,000
Less: Variable cost	200	300	150	650
Contribution	100	100	150	350
Fixed cost	70	50	62	182

(i) P/V ratio of merged plant

$$\frac{\text{Contribution of merged plant}}{\text{Turnover of merged plant}} \times 100 = \frac{₹\ 350 \text{ lakhs}}{1{,}000 \text{ lakhs}} \times 100 = 35\%$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{P/V Ratio}} = \frac{₹\ 182 \text{ lakhs}}{35\%} = ₹\ 520 \text{ lakhs}$$

Capacity of the merged plant at break-even point

$$= \frac{\text{Turnover at break-even point}}{\text{Total turnover}} \times 100 = \frac{\text{Rs. 520 lakhs}}{\text{Rs. 1,000 lakhs}} = 52\%$$

(ii) Profit at 75% capacity of merged plant

Sales at 75% capacity = ₹ 750 lakhs.

Contribution at 75% capacity = 750 × 35% = ₹ 262.5 lakhs

Fixed cost = ₹ 182 lakhs

Profit = ₹ 262.5 – 182 = **₹ 80.5 lakhs**

(iii) Sales to earn a profit of ₹ 28 lakhs

$$= \frac{\text{Fixed cost} + \text{Profit}}{\text{P/V ratio}} = \frac{182 + 28}{35\%} = ₹\ 600 \text{ lakhs.}$$

Problem 5.12

(*a*) *ABC* Ltd. manufactures and sells four types of products under the brand names, *A*, *B*, *C* and *D*. The sales mix in value comprises 33⅓%, 41⅔%, 16⅔% 8⅓% of *A*, *B*, *C* and *D* respectively. The total budgeted sales (100%) are ₹ 60,000 per month. Operating costs are as follows:

Variables costs:

Product *A* 60% of selling price; *B* 68% of selling price; *C* 80% of selling price; *D* 40% of selling price

Fixed cost is ₹ 14,700 per month.

Calculate the break-even point for the products on an overall basis.

(*b*) It has been proposed to change the sales mix as follows, the total sales per month remaining ₹ 60,000.

Product *A* 25%; *B* 40%; *C* 30%; *D* 5%

Assuming that proposal is implemented, calculate the break-even point. (*B.Com. Hons., Delhi*)

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Solution

(a)

	Products				
	A	B	C	D	Total
Sales mix	33⅓ %	41⅔ %	16⅔ %	8⅓ %	100%
	₹	₹	₹	₹	₹
Sales	20,000	25,000	10,000	5,000	60,000
Variable cost	12,000	17,000	8,000	2,000	39,000
Contribution					21,000
Less: Fixed costs					14,700
Profit					6,300

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{Contribution}} \times \text{Sales} = \frac{14,700}{21,000} \times 60,000 = ₹\ 42,000$$

(b)

	Products				
	A	B	C	D	Total
Revised sales mix %	25%	40%	30%	5%	100%
Sales ₹	15,000	24,000	18,000	3,000	60,000
Variable cost ₹	9,000	16,320	14,400	1,200	40,920
Contribution ₹					19,080
Less: Fixed cost ₹					14,700
				Profit ₹	4,380

$$\text{Break-even point} = \frac{14,700}{19,080} \times 60,000 = ₹\ 46,226 \text{ (Approx).}$$

Problem 5.13

You are given the following data :

	Sales	Profit
Year 2016	₹ 1,20,000	8,000
Year 2017	₹ 1,40,000	13,000

Find out—

(i) P/V ratio,

(ii) B.E. Point,

(iii) Profit when sales are ₹ 1,80,000,

(iv) Sales required to earn a profit of ₹ 12,000.

(v) Margin of safety in year 2017.

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Solution

		Sales	Profit
Year 2016	₹	1,20,000	8,000
Year 2017	₹	1,40,000	13,000
Difference	₹	20,000	5,000

(i) P/V ratio = $\frac{\text{Difference in profit}}{\text{Difference in sales}} \times 100 = \frac{5,000}{20,000} \times 100 = 25\%$

	₹
Contribution in 2016 (1,20,000 × 25%)	30,000
Less: Profit	8,000
Fixed cost*	22,000

*Contribution = Fixed cost + Profit

∴ Fixed cost = Contribution – Profit

(*ii*) Break-even point = $\frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{22,000}{25\%}$ = **₹ 88,000**

(*iii*) *Profit when sales are* ₹ 1,80,000

	₹
Contribution (₹ 1,80,000 × 25%)	45,000
Less: Fixed cost	22,000
Profit	23,000

(*iv*) Sales to earn a profit of ₹ 12,000

$\frac{\text{Fixed cost + Desired profit}}{\text{P/V ratio}} = \frac{22,000 + 12,000}{25\%}$ = **₹ 1,36,000**

(*v*) Margin of safety in 2017 –

Margin of safety = Actual sales – Break-even sales

= 1,40,000 – 88,000 = **₹ 52,000**

Problem 5.14

Given below are the sales and profits of the two halves of the year :

		Ist half	*IInd half*
Sales	₹	1,00,000	1,20,000
Profit	₹	30,000	38,000

Fixed cost during the first half is equal to that during the second half. Selling price and per unit variable cost remain unchanged. Calculate the following :

(*i*) P/V ratio for each half and for the full year.

(*ii*) Fixed cost for each half and for the full year.

(*iii*) BEP for each half and for the full year.

(*iv*) Half-yearly sales to earn half-yearly profit of ₹ 40,000.

(*v*) Annual sales to earn annual profit of ₹ 90,000. *(B. Com. Hons. Delhi)*

Solution

(*i*) P/V ratio = $\frac{\text{Difference in Profit}}{\text{Difference in sales}} = \frac{38,000 - 30,000}{1,20,000 - 1,00,000} = \frac{8,000}{20,000}$ = **40%**

For each of the half year P/V ratio will remain the same *i.e.* 40%.

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(ii) Fixed cost = (Sales × P/V ratio) – Profit
Ist half = (1,00,000 × 40%) – 30,000 = ₹ 10,000
For full year, fixed cost = ₹ 10,000 × 2 = ₹ 20,000

(iii) B.E. Point = $\frac{F}{P/V \text{ ratio}}$

Ist half = $\frac{10,000}{40\%}$ = ₹ 25,000

BE Point for full years = ₹ 25,000 × 2 = ₹ 50,000

(iv) Required sales = $\frac{F+P}{P/V \text{ ratio}}$

Half year sales = $\frac{10,000 + 40,000}{40\%}$ = ₹ 1,25,000

(v) Annual sales = $\frac{20,000 + 90,000}{40\%}$ = ₹ 2,75,000

Problem 5.15

A company sold in two successive periods 7,000 units and 9,000 units and has incurred a loss of ₹ 10,000 and earned ₹ 10,000 as profit respectively. The selling price per unit can be assumed at ₹ 100. You are required to calculate:

(a) The amount of fixed cost

(b) The number of units to break-even

(c) The number of units to earn a profit of ₹ 40,000.

(I.C.W.A. Inter)

Solution

	Period I	*Period II*	*Difference*
	₹	₹	₹
Sales (@ ₹ 100 per unit)	7,00,000	9,00,000	2,00,000
Profit/Loss (–)	(–) 10,000	10,000	20,000

P/V ratio = $\frac{\text{Difference in Profit}}{\text{Difference in sales}} \times 100 = \frac{20,000}{2,00,000} \times 100 = 10\%$

Contribution period I (10% of ₹ 7,00,00)	₹ 70,000
Add: Loss in period I	₹ 10,000
(a) Fixed cost	₹ 80,000

Note: Fixed Cost = Contribution – Profit (or Contribution + Loss)

(b) Break-even point = $\frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{80,000}{10\%}$ = ₹ 8,00,000

Number of units to break-even = 8,00,000 ÷ 100 = **8,000 units**

(c) Required Sales = $\frac{\text{Fixed cost + Desired profit}}{\text{P/V ratio}}$

= $\frac{80,000 + 40,000}{10\%}$ = **₹ 12,00,000 or 12,000 units**

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Problem 5.16

A company has annual fixed costs of ₹ 14,00,000. In 2017 sales amounted to ₹ 60,00,000 as compared with ₹ 45,00,000 in 2016 and profit in 2017 was ₹ 4,20,000 higher than in 2016.

(*i*) At what level of sales does the company break-even?

(*ii*) Determine profit or loss on a precast sales volume of ₹ 80,00,000.

(*iii*) If there is a reduction in selling price in 2018 by 10% and the company desires to earn the same profit as in 2017, what would be the required sales? *(B.Com. Hons., Delhi)*

Solution

$$\text{P/V ratio} = \frac{\text{Increase in profit}}{\text{Increase in sales}} \times 100 = \frac{4,20,000}{60,00,000 - 45,00,000} \times 100$$

$$= \frac{4,20,000}{15,00,000} \times 100 \quad = 28\%$$

(*i*) Break-even Point $= \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{14,00,000}{28\%} =$ **₹ 50,00,000**

(*ii*) When sales are ₹ 80,00,000

	₹
Contribution = 80,00,000 × 28%	22,40,000
Less: Fixed cost	14,00,000
Profit	**8,40,000**

(*iii*) When selling price is 10% less

Sales = 80,00,000 − 10%	= 72,00,000
Less: Variable cost (80,00,000 × 72%*)	57,60,000
New contribution	14,40,000

*Ratio of variable cost to sales = 100 − 28% = 72%

New P/V ratio $= \frac{C}{S} = \frac{14,40,000}{72,00,000} \times 100 =$ **20%**

Profit in 2017 = (60,00,000 × 28%) − 14,00,000 = ₹ 2,80,000

Sales to earn the desired profit

$$= \frac{\text{Fixed cost} + \text{Desired profit}}{\text{P/V ratio}} = \frac{14,00,000 + 2,80,000}{20\%} =$$ **₹ 84,00,000.**

Problem 5.17

The following figures relating to the performance of a company of the years I and II are available. Assuming that (*i*) the ratio of variable costs to sales, and (*ii*) the fixed costs are the same for both the years, ascertain :

(*a*) the Profit-volume ratio, (*b*) the amount of the fixed costs,

(*c*) the Break-even point, and

(*d*) the budgeted profit for the year III, if the budgeted sales for that year are ₹ 1 crores.

	Total sales (₹ in '000)	*Total costs (₹ in '000)*
Year I	7,000	5,800
Year II	9,000	6,600

(I.C.W.A. Inter)

Solution

	Sales (₹ in '000)	Total cost (₹ in '000)	Profit (₹ in '000)
Year I	7,000	5,800	1,200
Year II	9,000	6,600	2,400
Difference	2,000	800	1,200

(a) P/V ratio $= \frac{1,200}{2,000} \times 100 = 60\%$

(b) Fixed cost = (Sales × P/V ratio) − Profit

Year I = (70,00,000 × 60%) − 12,00,000 = **₹ 30,00,000**

(c) B.E.Point $= \frac{F}{P/V \text{ ratio}} = \frac{30,00,000}{60\%} =$ **₹ 50,00,000**

(d) Budgeted sales = 100,00,000

Contribution = 100,00,000 × 60% = 60,00,000

Profit = C − F

= 60,00,000 − 30,00,000 = **₹ 30,00,000.**

Problem 5.18

A company had incurred fixed expenses of ₹ 4,50,000, with sales of ₹ 15,00,000 and earned a profit of ₹ 3,00,000 during the first half year. In the second half, it suffered a loss of ₹ 1,50,000.

Calculate:

(i) The profit-volume ratio, break-even point and margin of safety for the first half year.

(ii) Expected sales volume f or the second half year assuming that selling price and fixed expenses remained unchanged during the second half year.

(iii) The break-even point and margin of safety for the whole year. *(C.A. Inter)*

Solution

(i) **In the First half year**

Contribution = Fixed cost + Profit

= 4,50,000 + 3,00,000 = ₹ 7,50,000

P/V ratio $= \frac{C}{S} = \frac{7,50,000}{15,00,000} =$ **50%**

Break-even point $= \frac{\text{Fixed cost}}{P/V \text{ ratio}} = \frac{4,50,000}{50\%} =$ **₹ 9,00,000**

Margin of safety = Actual sales − Break-even point

= 15,00,000 − 9,00,000 = **₹ 6,00,000**

(ii) **In the second half year**

Contribution = Fixed cost − Loss

= 4,50,000 − 1,50,000 = ₹ 3,00,000

Expected sales volume $= \frac{\text{Fixed cost} - \text{Loss}}{P/V \text{ rotio}} = \frac{3,00,000}{50\%} =$ **₹ 6,00,000**

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(iii) **For the whole year**

$$\text{B.E. point} = \frac{\text{Fixed Cost}}{\text{P/V ratio}} = \frac{4,50,000 \times 2}{50\%} = ₹\ 18,00,000$$

$$\text{Margin of safety} = \frac{\text{Profit}}{\text{P / V ratio}} = \frac{30,00,00 - 1,50,000}{50\%} = ₹\ 3,00,000$$

Problem 5.19

The following costs and sales of a manufacturing company for the first half and second half of 2017 are given :

	First half	*Second half*
	₹	₹
Sales	24,00,000	30,00,000
Total costs	21,80,000	26,00,000

You are asked to determine :

(i) Contribution/Sales ratio of the firm.
(ii) Annual fixed costs.
(iii) Break-even point.
(iv) Margin of safety as percentage of sales.

(I.C.W.A. Inter)

Solution

	I Half	*II Half*	*Difference*
Sales (₹)	24,00,000	30,00,000	6,00,000
Less: Total cost (₹)	21,80,000	26,00,000	4,20,000
Profit	2,20,000	4,00,000	1,80,000

(i) **P/V ratio (or C/S ratio)** $= \frac{\text{Difference in profit}}{\text{Differences in sales}} \times 100 = \frac{1,80,000}{6,00,000}$ **30%**

(ii) **Fixed Cost** = Total sales for the year = 24,00,00 + 30,00,000
= ₹ 54,00,000

Contribution = 54,00,000 × 30%	16,20,000
Less: Profit (2,20,000 + 4,00,000)	6,20,000
Fixed cost	10,00,000

(iii) **Break-even point** $= \frac{F}{\text{P/V ratio}} = \frac{10,00,000}{30\%} = ₹\ 33,33,333$

(iv) **Margin of safety** $= \frac{\text{Sales} - \text{BEP}}{\text{Sales}} \times 100 = \frac{54,00,000 - 33,33,333}{54,00,000} = 38.27\%.$

Problem 5.20

A company manufactures a single product having a marginal cost of ₹ 0.75 a unit. Fixed costs are ₹ 12,000. The market is such that up to 40,000 units can be sold at ₹ 1.50 a unit, but any additional sales must be made at ₹ 1.00 a unit. There is a planned profit of ₹ 20,000. How many units must be made and sold?

(B.Com. Hons. Delhi)

Solution

Planned profit	= ₹	20,000
Add: Fixed cost	₹	12,000
Contribution required	₹	32,000

Contribution per unit = ₹ 1.50 – 0.75 = ₹ 0.75
Contribution from 40,000 units = 40,000 × 0.75 = ₹ 30,000
New contribution = ₹ 1 – 0.75 = ₹ 0.25 p.u.
Additional contribution of ₹ 2,000 @ ₹ 0.25 p.u. will require 8,000 units
Total sales required = 40,000 + 8,000 = **48,000 units.**

Problem 5.21

A company wants to buy a new machine to replace one which is having frequent break-down. It received offers for two models M_1 and M_2. Further details regarding these models are given below :

	M_1	M_2
Installed capacity (units)	10,000	10,000
Fixed overhead per annum (₹)	2,40,000	1,00,000
Estimated profit at the above capacity (₹)	1,60,000	1,00,000

The product manufactured using this type of machine (M_1 or M_2) is sold at ₹ 100 per unit. You are required to determine :

(a) Break-even level of sales for each model.
(b) The level of sales at which both the models will earn the same profit.
(c) The model suitable for different level of demand for the product.

Solution

(a) Contribution = Fixed cost + Profit

M_1 = 2,40,000 + 1,60,000 = ₹ 4,00,000
M_2 = 1,00,000 + 1,00,000 = ₹ 2,00,000
Sales @ ₹ 100 per unit (For M_1 and M_2) = ₹ 10,00,000

$$\text{P/V ratio} = \frac{C}{S} \times 100$$

$$M_1 = \frac{4,00,000}{10,00,000} \times 100 = 40\%$$

$$M_2 = \frac{2,00,000}{10,00,000} \times 100 = 20\%$$

B.E. Point = Fixed cost ÷ P/V ratio

M_1 = 2,40,000 ÷ 40% = ₹ 6,00,000.
M_2 = 1,00,000 ÷ 20% = ₹ 5,00,000.

(b) Sales at which both the models will earn the same profit

$$= \frac{\text{Difference in fixed cost}}{\text{Difference in P/V ratio}} = \frac{2,40,000 - 1,00,000}{40\% - 20\%}$$

$$= \frac{1,40,000}{20\%} = \textbf{₹ 7,00,000 or 7,000 units}$$

At sales of ₹ 7,00,000, both M_1 and M_2 will earn the same profit.

Profit at sales of ₹ 7,00,000

M_1 = (7,00,000 × 40%) – 2,40,000 = ₹ 40,000
M_2 = (7,00,000 × 20%) – 1,00,000 = ₹ 40,000.

(c) M_2 has a lower break-even point and thus is suitable when demand is low upto 7,000 units. When demand is move than 7,000 units, M_1 will give larger profit because it has a higher P/V ratio.

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Problem 5.22

Company *A* and Company *B*, both under the same management, make and sell the same type of product. Their budgeted profit and loss account for June are as under :

		Company A		Company B	
		₹	₹	₹	₹
	Sales		3,00,000		3,00,000
Less:	Variable cost	2,40,000		2,00,000	
	Fixed cost	30,000	2,70,000	70,000	2,70,000
	Profit		30,000		30,000

Your are required to :

(*i*) Calculate the break-even point for each.

(*ii*) Calculate the sales volume at which each of the two companies will make a profit of ₹ 10,000.

(*iii*) Assess how their profitability will change with increase or decrease in sales volume.

(*C.A., Inter*)

Solution

Contribution = Fixed cost + Profit

$A = 30,000 + 30,000 = ₹\ 60,000$

$B = 70,000 + 30,000 = ₹\ 1,00,000$

P/V ratio : $= \frac{C}{S} \times 100$

$A = \frac{60,000}{3,00,000} = 20\%$ or 1/5

$B = \frac{1,00,000}{3,00,000} = 33\frac{1}{3}\%$ or 1/3

(*i*) B.E.P. $= \frac{F}{P/V \text{ ratio}}$

$A = \frac{30,000}{20\%} = ₹\ 1,50,000$

$B = \frac{70,000}{1/3} = ₹\ 2,10,000$

(*ii*) Sales to earn a desired profit $= \frac{\text{Fixed cost + Desired profit}}{\text{P/V ratio}}$

$A = \frac{30,000 + 10,000}{20\%} = ₹\ 2,00,000$

$B = \frac{70,000 + 10,000}{33\frac{1}{3}\%} = ₹\ 2,40,000$

(*iii*) When there is an increase in volume of business, a company with larger P/V ratio can earn larger profits. In this case company *B* would earn larger profits in conditions of heavy demand.

When there is decrease in volume of business, a company with lower break-even point is better off. In this case company *A* will start earning profits when its sales reach the level of ₹ 1,50,000 whereas profits will start at ₹ 2,10,000 in the case of company *B*. Thus, in conditions of lower demand, company *A* will be better.

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Problem 5.23

(a) If margin of safety is ₹ 2,40,000 (40% of sales) and P/V ratio is 30% of *AB* Ltd, calculate its (1) Break even sales, and (2) Amount of profit on sales of ₹ 9,00,000.

(b) *X* Ltd has earned a contribution of ₹ 2,00,000 and net profit of ₹ 1,50,000 on sales of ₹ 8,00,000. What is its margin of safety? *(C.A. Inter)*

Solution

(a) Total sales = $2,40,000 \times \frac{100}{40}$ = ₹ 6,00,000

Contribution = 6,00,000 × 30% = ₹ 1,80,000

Profit = M/S × P/V ratio = 2,40,000 × 30% = ₹ 72,000

Fixed cost = Contribution – Profit
= 1,80,000 – 72,000 = ₹ 1,08,000

(1) Break-even sales = $\frac{F}{P/V \text{ ratio}} = \frac{1,08,000}{30\%}$ = **₹ 3,60,000**

(2) Profit = (Sales × P/V ratio) – Fixed cost
= (9,00,000 × 30%) – 1,08,000 = **₹ 1,62,000**

(b) P/V ratio = $\frac{C}{S} = \frac{2,00,000}{8,00,000}$ = 25%

Margin of safety = $\frac{\text{Profit}}{P/V \text{ ratio}} = \frac{1,50,000}{25\%}$ = **₹ 6,00,000**

Alternatively,

Fixed cost = Contribution – Profit
= 2,00,000 – 1,50,000 = ₹ 50,000

B.E. Point = 50,000 ÷ 25% = ₹ 2,00,000

Margin of safety = Actual sales – B.E. sales
= 8,00,000 – 2,00,000 = ₹ 6,00,000.

Problem 5.24

(a) A company earned a profit of ₹ 30,000 during the year 2017. If the marginal cost and selling price of the product are ₹ 8 and ₹ 10 per unit respectively, find out the amount of margin of safety.

(b) The ratio of variable cost to sales is 70%. The break-even point occurs at 60% of the capacity sales. Find the capacity sales when fixed costs are ₹ 90,000. Also compute profit at 75% of the capacity sales. *(C.A. Inter)*

Solution

(a) P/V ratio = $\frac{S-V}{S} = \frac{10-8}{10}$ = 20%

Margin of safety = $\frac{\text{Profit}}{P/V \text{ ratio}} = \frac{30,000}{20\%}$ = **₹ 1,50,000**

(b) P/V ratio = 100 – 70 = 30%

Break-even point = $\frac{F}{P/V \text{ ratio}} = \frac{90,000}{30\%}$ = **₹ 3,00,000**

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$$100\% \text{ capacity sales} = \frac{₹\ 3,00,000}{60\%} = ₹\ 5,00,000$$

Sales at 75% capacity = ₹ 5,00,000 × 75% = ₹ 3,75,000

Profit at 75% = (3,75,000 × 30%) − 90,000 = ₹ 22,500

Problem 5.25

In a purely competitive market, 10,000 pocket transistors can be manufactured and sold and a certain profit is generated. It is estimated that 2,000 pocket transistors need be manufactured and sold in a monopoly market to earn the same profit.

Profit under both the conditions is targeted at ₹ 2,00,000. The variable cost per transistor is ₹ 100 and the total fixed cost is ₹ 37,000.

You are required to find out the unit selling prices both under monopoly and competitive conditions.

(B. Com Hons Delhi;)

Solution

Under Monopolistic Conditions

Suppose x is the selling price per unit

∴ Sales = $2,000x$

Variable cost = 2,000 × ₹ 100 = ₹ 2,00,000

Fixed cost = ₹ 37,000

Desired profit = ₹ 2,00,000

S − V = F + P

or $2,000x - 2,00,000 = 37,000 + 2,00,000$

$$x = \frac{4,37,000}{2,000} \text{ or } ₹\ 218.50 \text{ per unit}$$

Thus, selling price = **₹ 218.50 per unit.**

Under Competitive Conditions

Suppose x is the selling price per unit

Sales = $10,000x$

Variable cost = 10,000 × ₹ 100 or ₹ 10,00,000

Fixed cost = ₹ 37,000

Desired profit = ₹ 2,00,000

or $10,000x - 10,00,000 = 2,37,000$

$$x = \frac{12,37,000}{10,000} \text{ or } ₹\ 123.70 \text{ per unit}$$

Thus selling price = **₹ 123.70 per unit.**

Problem 5.26

Cadbury Drink Co. is planning to establish a subsidiary company in India to produce Mineral Water. Based on the estimated annual sales of 40,000 bottles of the mineral water, cost studies produced the following estimates for the Indian subsidiary:

	Total annual cost ₹	*Per cent of total annual cost that is variable*
Material	1,93,600	100%

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		90,000	
Labour			70%
Overhead	— Factory	80,000	
			64%
	— Administration	30,000	
			30%

The Indian production will be sold by manufacturer's representatives who will receive a commission of 8% of the sale price. No portion of the British Office expenses is to be allowed to the Indian subsidiary. It is required to:

(i) Compute the sale price per bottle to enable management to realise an estimated 10% profit on sale proceeds in India, and

(ii) Calculate the break-even point in ₹ for the Indian subsidiary on the assumption that the sale price is ₹ 11 per bottle.

(B.Com. Hons. Delhi)

Solution

(i) Let the selling price per unit be X

Total sales	$40,000\ X$
Total commission (8% of sales)	$3,200\ X$
Total profit (10% of sales)	$4,000\ X$

Total sales = Total cost + Profit

$$40,000\ X = 1,93,600 + 90,000 + 80,000 + 30,000 + 3,200\ X + 4,000\ X$$
$$40,000\ X = 3,93,600 + 7,200\ X$$
$$32,800\ X = 3,93,600$$
$$X = ₹\ 12$$

Thus selling price of ₹ 12 gives a profit of 10% on sales.

			₹
(ii) Sales (40,000 × 11)			4,40,000
Less: Marginal cost:		₹	
Material		1,93,600	
Labour (90,000 × 70%)		63,000	
Factory Overhead (80,000 × 64%)		51,200	
Administration (30,000 × 30%)		9,000	
Sales commission (4,40,000 × 8%)		35,200	3,52,000
Contribution			88,000
Fixed cost	30% of ₹ 90,000		₹ 27,000
	36% of ₹ 80,000		₹ 28,800
	70% of ₹ 30,000		₹ 21,000
	Total fixed cost		₹ 76,800

$$\text{B.E. Point} = \frac{F}{C} \times S = \frac{76,800}{88,000} \times 4,40,000 = \textbf{₹ 3,84,000.}\ \text{(or 34,909 units)}$$

Problem 5.27

A company sells its product at ₹ 15 per unit. In a period if it produces and sells 8,000 units, it incurs a loss of ₹ 5 per unit. If the volume is raised to 20,000, it earns a profit of ₹ 4 per unit.

Calculate the break-even point.

(B.Com. Hons. Delhi)

Solution

	Sales ₹	*Profit/Loss (–)* ₹
At 8,000 units	1,20,000	(–) 40,000
At 20,000 units	3,00,000	+ 80,000
Difference	1,80,000	1,20,000

$$\text{P/V ratio} = \frac{\text{Difference in Profit}}{\text{Difference in Sales}} = \frac{1,20,000}{1,80,000} = \frac{2}{3}$$

Fixed cost = (S × P/V ratio) – Profit = (3,00,000 × 2/3) – 80,000 = ₹ 1,20,000

Break-even point = F ÷ P/V ratio = 1,20,000 ÷ 2/3 = **₹ 1,80,000.**

Problem 5.28

The following is the budget of Cadila Co.:

	Fixed ₹	*Variable* ₹	*Total* ₹
Budgeted sales:			
2,00,000 units @ ₹ 25 each	—	—	50,00,000
Budgeted costs:			
Direct material		9,00,000	
Direct labour		10,00,000	
Factory overhead	7,00,000	3,00,000	
Administration overhead	6,00,000	1,00,000	
Distribution overhead	5,00,000	3,00,000	
Total	18,00,000	26,00,000	44,00,000
Budgeted profit			6,00,000

Compute the break-even point in the following independent situations if:

(*i*) 10% increase is effected in fixed costs.

(*ii*) 10% increase is effected in variable costs.

(*iii*) 10% increase is effected in sale price which results in reduction in units sold by 5%.

(*iv*) 10% increase in fixed costs and 5% decrease in variable costs is effected. *(C.S. Inter)*

Solution

	(i) 10% increase in fixed costs	*(ii) 10% increase in variable cost*	*(iii) 10% increase in S.P. and 5% reduction in sales units*	*(iv) 10% increase in F.C. and 5% decrease in V.C.*
	₹	₹	₹	₹
Selling price	25.00	25.00	27.50	25.00
Less: Variable cost	13.00	14.30	13.00	12.35
Contribution per unit (C)	12.00	10.70	14.50	12.65
Fixed cost (F)	19,80,000	18,00,000	18,00,000	19,80,000
B.E.P. = F ÷ C (in units)	1,65,000	1,68,224	1,24,138	1,56,522
B.E.P. (in ₹)	41,25,000	42,05,600	34,13,795	39,13,050

Notes 1. Variable cost per unit = $\frac{\text{Total variable cost}}{\text{Units sold}} = \frac{26,00,000}{2,00,000}$ = ₹ 13

2. B.E.P. (in ₹) is BEP in units multiplied by the respective selling price per unit.

Problem 5.29

From the following particulars, find the most profitable product mix and prepare a statement of profitability of that product mix:

	Product A	*Product B*	*Product C*
Units budgeted to be produced and sold	1,800	3,000	1,200
Selling price per unit ₹	60	55	50
Requirement per unit:			
Direct materials	5 kg	3 kg	4 kg
Direct labour	4 hrs.	3 hrs.	2 hrs.
Variable overheads	₹ 7	₹ 13	₹ 8
Fixed overheads	₹ 10	₹ 10	₹ 10
Cost of direct materials per kg.	₹ 4	₹ 4	₹ 4
Direct labour hour rate	₹ 2	₹ 2	₹ 2
Maximum possible units of sales	4,000	5,000	1,500

All the three products are produced from the same direct material using the same type of machines and labour. Direct labour, which is the key factor is limited to 18,600 hours. (*B. Com*)

Solution

Profitability Statement

Particulars	*Per unit of Products*		
	A	*B*	*C*
	₹	₹	₹
(*i*) Selling price	60	55	50
Direct materials @ ₹ 4 per kg.	20	12	16
Direct labour @ ₹ 2 per hr.	8	6	4
Variable overheads	7	13	8
(*ii*) Total variable costs	35	31	28
(*iii*) Contribution (*i*)–(*ii*)	25	24	22
(*iv*) Direct labour hours per unit	4 hrs.	3 hrs.	2 hrs.
(*v*) Contribution per direct labour hr. (*iii*) ÷ (*iv*)	6.25	8.00	11.00
Ranking	**III**	**II**	**I**

Product Mix: Key factor is 18,600 direct labour hours. Maximum possible units of each product should be produced according to ranking. 18,600 labour hours will be utilised according to the following ranking.

	Labour hours
Product *C* (1,500 units × 2 hrs.)	3,000
Product *B* (5,000 units × 3 hrs.)	15,000
Product *A* (600 hrs ÷ 4 hrs. = 150 units) Balance hours	600
Total	18,600

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Statement of Profit

	Products C	B	A	Total ₹
Production (units)	1,500	5,000	150	
Contribution per unit	₹ 22	24	25	
Total contribution	₹ 33,000	1,20,000	3,750	1,56,750
Less: Fixed cost				60,000*
			Profit	96,750

*Calculation of fixed cost is based on budgeted units

A	1,800	units @ ₹ 10	= ₹ 18,000
B	3,000	units @ ₹ 10	= ₹ 30,000
C	1,200	units @ ₹ 10	= ₹ 12,000
		Total	60,000

Problem 5.30

The following particulars are extracted from the records of a company:

	Product A	Product B
Selling price (per unit)	₹ 100	₹ 120
Consumption of material	2 kg.	3 kg.
Material cost	₹ 10	₹ 15
Direct wages	₹ 15	₹ 10
Direct expenses	₹ 5	₹ 6
Machine hours used	3	2
Overhead expenses :		
Fixed	₹ 5	₹ 10
Variable	₹ 15	₹ 20

Direct wages per hour is ₹ 5.

(*a*) Comment on the profitability of each product (both use the same raw material) when:
- (*i*) Total sales potential in units is limited;
- (*ii*) Total sales potential in value is limited;
- (*iii*) Raw material is in short supply; and
- (*iv*) Production capacity (in terms of machine hours) is the limiting factor.

(*b*) Assuming raw material as the key factor, availability of which is 10,000 kg., and maximum sales potential of each product being 3,500 units, find out the product mix which will yield the maximum profit.

(B.Com. Hons., Delhi, I.C.W.A., Inter)

Solution (*a*)

Statement of Marginal Cost and Contribution

	Per unit of A ₹	B ₹
Sales	100	120
Direct materials	10	15
Direct wages	15	10

Direct expenses	Marginal Cost	5	6
Variable overhead		15	20
Contribution		45	51
P/V ratio		55	69
Contribution per kg. of material		55%	57.5%
Contribution per machine hour		27.5	23
		18.3	34.5

Comments: Best position is reached when contribution per unit of key factor is maximum.

(*i*) When total sales potential in units is a limiting factor, *B* is more profitable as it is making a larger contribution per unit as compared to *A*.

(*ii*) When total sales potential in value is a limiting factor, still B is more profitable as its P/V ratio is more than that of *A*.

(*iii*) When raw material is in short supply, *A* is more profitable as its contribution per kg. of material is more than that of product *B*.

(*iv*) When production capacity is limited, B is more profitable as it makes larger contribution per machine hour than *A*.

(*b*) When raw material is a key factor, *A* is more profitable as its contribution per kg. of material is higher than *B*. If 3,500 units of *A* are manufactured, total material consumption will be 7,000 kg. (*i.e.*, 3,500 × 2 kg). The balance 3,000 kg. of material can be used to manufacture 1,000 units (3,000 kg. ÷ 3) of *B*. Thus the product mix is 3,500 units of *A* and 1,000 units of *B*.

Problem 5.31

On the basis of the following data, work out the expected profits, capacity utilisation (in %), break-even point and margins of safety (in terms of quantity and value in both the cases) for the years 2014-15 and 2015-16

	2014-15	*2015-16*
Production capacity (in units)	2 lakhs	3 lakhs
Production/sales (in units)	1.8 lakhs	2.25 lakhs
Selling price per unit	₹ 6	₹ 6.50
Variable cost per unit	₹ 3	₹ 3.30
Fixed expenses (including depreciation)	₹ 3 lakhs	₹ 5.12 lakhs

(*I.C.W.A. Inter*)

Solution

	2014-15	*2015-16*
Capacity utilisation %	$\frac{1.8 \text{ lakhs}}{2 \text{ lakhs}} = 90\%$	$\frac{2.25 \text{ lakhs}}{3 \text{ lakhs}} = 75\%$
Break-even point in units $\left(\frac{\text{Fixed cost}}{\text{S}-\text{V}}\right)$	$= \frac{3,00,000}{6-3}$ = 1,00,000 units	$= \frac{5,12,000}{6.50-3.30}$ 1,60,000 units
Break-even point in ₹	1,00,000 × ₹ 6 = ₹ 6,00,000	1,60,000 × ₹ 6.50 = ₹ 10,40,000
Margin of safety (units)	1,80,000 – 1,00,000	2,25,000 – 1,60,000

(Sales units – B.E. quantity)	= 80,000 units	= 65,000 units.
Margin of safety in ₹	80,000 × ₹ 6	65,000 × ₹ 6.50
	= ₹ 4,80,000	= ₹ 4,22,500
Calculation of Expected Profit	₹	₹
Sales (Actual quantity × S.P.)	10,80,000	14,62,500
Less: Variable cost (Units × V.C. per unit)	5,40,000	7,42,500
Contribution	5,40,000	7,20,000
Less: Fixed cost	3,00,000	5,12,000
Profit	2,40,000	2,08,000

Problem 5.32

(*i*) When volume is 3,000 units, average cost is ₹ 4 per unit. When volume is 4,000 units, average cost is ₹ 3.50. The break-even point is 5,000 units. Find the profit-volume ratio.

(*ii*) *ABC* Ltd. has fixed costs of ₹ 2,00,000. It has two products that it can sell. *A* and *B*. The company sells these products at a rate of 2 units of A to 1 unit of *B*. The unit contibution is ₹ 1 per unit for *A* and ₹ 2 per unit for *B*. How many units of *A* and *B* would be sold at the break-even point ?

(*iii*) If margin of safety is 40% of sales, find fixed costs when profit is ₹ 200,000.

(B.Com. Hons. Delhi, Adapted)

Solution

(*i*)

	Output	*Average cost*	*Total cost*
	3,000 units	₹ 4.00	₹ 12,000
	4,000 units	₹ 3.50	₹ 14,000
Difference	1,000 unit		₹ 2,000

Variable cost per unit = ₹ 2,000 ÷ 1000 units = ₹ 2

Total Fixed cost = ₹ 12,000 – (3000 units × ₹ 2) = ₹ 6,000

or = ₹ 14,000 – (4000 units × ₹ 2) = ₹ 6,000

At BEP: Sales = Fixed cost + Variable cost

Cost at 5,000 units = (6,000 + 5,000 units × ₹ 2)

= ₹ 16,000

$$\text{BEP} = \frac{\text{Fixed cost}}{\text{P/V ratio}} \quad \text{or} \quad 16{,}000 = \frac{6{,}000}{\text{P/V ratio}}$$

or $$\text{P/V ratio} = \frac{6{,}000}{16{,}000} = \frac{3}{8} = \mathbf{37.50\%}$$

	A	*B*	*Total*
(*ii*) Sales (units)	2	1	3
Contribution per unit	₹ 1	₹ 2	
Total contribution	₹ 2	₹ 2	₹ 4

Contribution per unit (composite) = $\frac{₹\ 4}{3}$

Total fixed cost = ₹ 2,00,000.

$$\text{BEP (composite)} = \frac{₹\ 2,00,000}{4/3} = 1,50,000 \text{ units.}$$

BEP (in units) in the ratio of 2 : 1

$$A = 1,50,000 \times \frac{2}{3} = 1,00,000 \text{ units}$$

$$B = 1,50,000 \times \frac{1}{3} = 50,000 \text{ units}$$

Alternative Method

At BEP, let units of $B = x$

$\therefore$ units of $A = 2x$

$C = F + P$

$(2x \times 1) + (x \times 2) = 2,00,000 + 0$

$4x = 2,00,000$

$\therefore\ x = 50,000$ (units of B)

$2x = 1,00,000$ (units of A)

(iii) Margin of safety = 40%, Thus BEP = 60% of sales

$$\text{Margin of safety (M/S)} = \frac{\text{Profit}}{\text{P/V ratio}} \qquad \text{BEP} = \frac{\text{Fixed cost}}{\text{P/V ratio}}$$

$$\frac{\text{M/S}}{\text{BEP}} = \frac{\text{40\% of sales}}{\text{60\% of sales}} = \frac{\text{Profit / P/V. ratio}}{\text{Fixed cost / P/V. ratio}} = \frac{\text{Profit}}{\text{Fixed cost}}$$

or $$\frac{40\ \%}{60\ \%} = \frac{2}{3} = \frac{\text{Profit}}{\text{Fixed cost}} = \frac{20,000}{\text{Fixed cost}}$$

$$\text{Fixed cost} = \frac{60,000}{2} = ₹\ 30,000.$$

Problem 5.33

The following figures relate to a manufacturing company :

	₹
Annual sales at 100% effective capacity	12,00,000
Fixed overheads	4,00,000
Total variable costs	6,00,000

It is proposed to increase the capacity by the acquisition of 30% additional space and plant. It will result in increase of fixed overheads by ₹ 1,00,000 per annum.

Plot the foregoing figures on a single break-even chart and determine from the chart at what capacity utilisation the same profit as before will be produced after the extensions have been made.

(B.Com. Hons Delhi)

Solution

In the Fig. 5.14 of break-even chart, the new total cost line starts from ₹ 5 lakh point, indicating fixed cost has increase by ₹ 1 lakh. The profit at present is ₹ 2 lakhs. In order to determine the percentage capacity to earn the same profit and with increased cost, the total cost plus profit line starts from ₹ 7 lakhs (*i.e.*, ₹ 5 lakh for fixed cost plus ₹ 2 lakhs for profit) and runs parallel to the total cost line. Where this total cost plus profit line intersects the sales line, a perpendicular is drawn from this point to X-axis, which shows the percentage capacity utilisation 116.67% to earn the same profit as before.

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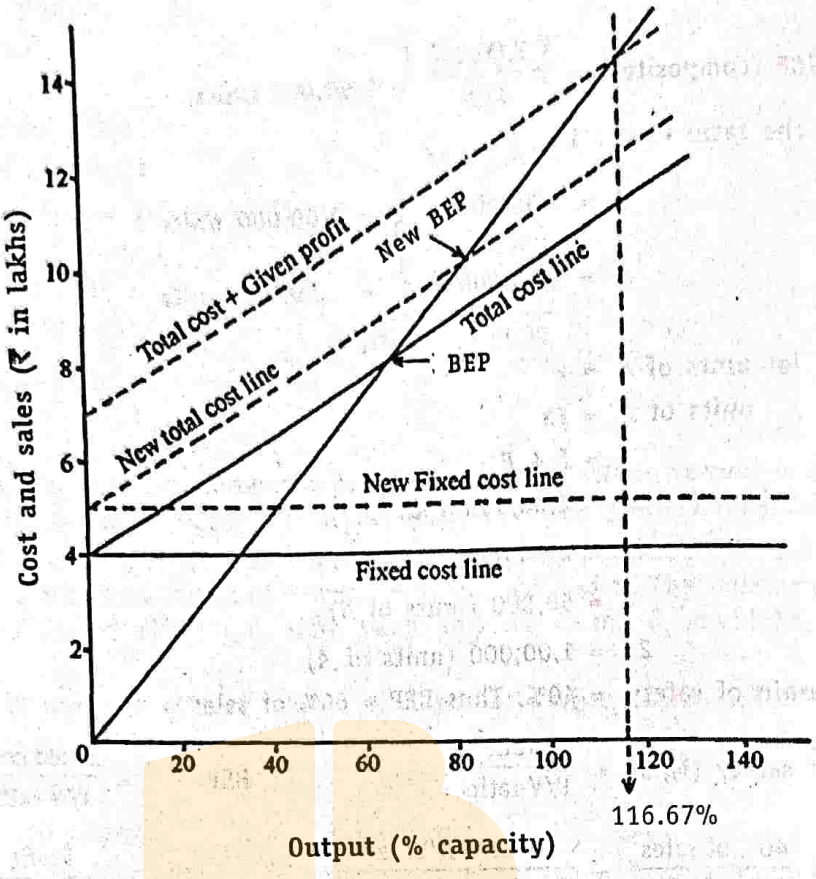

Fig. 5.14. Break-even chart.

Calculations

Present profit = Sales – Variable cost – Fixed cost
= 12,00,000 – 6,00,000 – 4,00,000 = ₹ 2,00,000

Contribution = Sales – Variable cost
= 12,00,000 – 6,00,000 = ₹ 6,00,000

New fixed cost = ₹ 4,00,000 + 1,00,000 = ₹ 5,00,000

$$\text{Break-even point (in \% capacity)} = \frac{\text{Fixed cost + Desired profit}}{\text{Contribution}} \times 100$$

$$= \frac{\text{Rs. } 5,00,000 + 2,00,000}{6,00,000} \times 100 = \frac{7,00,000}{6,00,000} \times 100 = \mathbf{116\frac{2}{3}}$$

$$116\frac{2}{3}\% \text{ in terms of expanded capacity} = \frac{116\frac{2}{3}\%}{130} \times 100 = \mathbf{89.75\%}$$

Problem 5.34

Following is the data taken from the records of a concern manufacturing a special part ZEE.

Selling price per unit	₹ 20
Direct material cost per unit	₹ 5

Direct labour cost per unit	₹ 3
Variable overhead cost per unit	₹ 2
Budgeted level of output	80,000 units
Budgeted recovery rate of fixed overheads cost per unit	₹ 5

You are required to :

(a) Draw a break-even chart and show the break-even point.

(b) In the same chart show the impact on break-even point :

(i) If selling price per unit is increased by 30% and

(ii) If selling price per unit is decreased by 10%. *(C.A. Inter)*

Solution

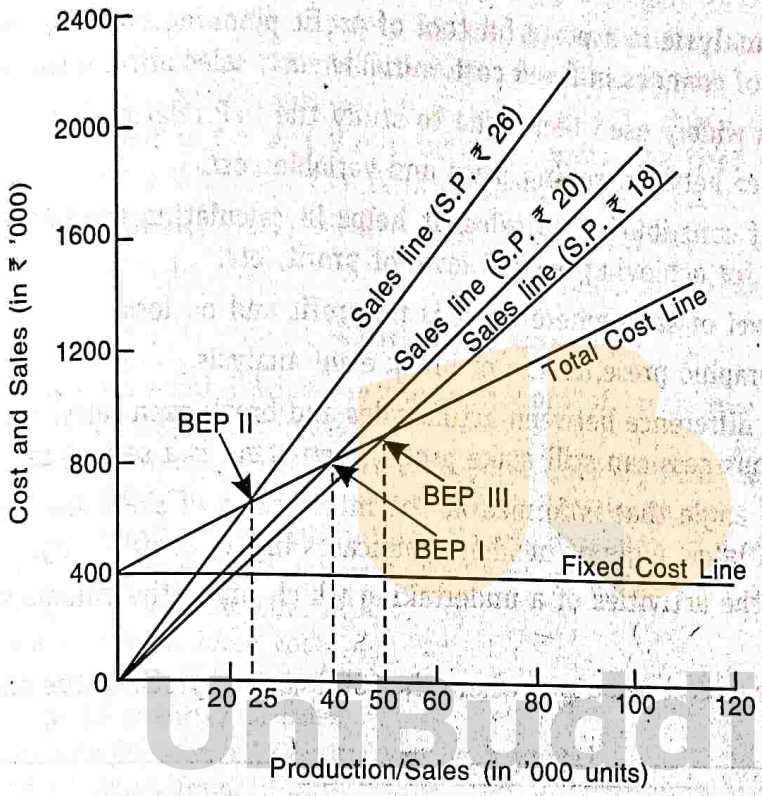

Fig. 5.15 Break-even chart.

When cost and selling prices are given per unit, then total cost and sales at various assumed levels of output are calculated to get necessary data for plotting on B.E. chart (See Fig. 5.15). For this purpose a table has been prepared as shown below:

Cost and sales at various assumed levels of production

Units	*V.C.* @ ₹ 10 p.u. ₹	*F.C.* ₹	*T.C.* ₹	*Sales* S.P. ₹ 20	S.P. ₹ 18	S.P. ₹ 26
20,000	2,00,000	4,00,000	6,00,000	4,00,000	3,60,000	5,20,000
40,000	4,00,000	4,00,000	8,00,000	8,00,000	7,20,000	10,40,000
60,000	6,00,000	4,00,000	10,00,000	12,00,000	10,80,000	15,60,000
80,000	8,00,000	4,00,000	12,00,000	16,00,000	14,40,000	20,80,000

VC = Variable cost, FC = Fixed cost, TC = Total cost

These figures are plotted in a break-even chart as follows :

When selling price is ₹ 20 per unit B.E. Point = 40,000 units
When selling price is ₹ 18 per unit B.E. Point = 50,000 units
When selling price is ₹ 26 per unit B.E. Point = 25,000 units

Verification

B.E. Point = F ÷ C

When S.P. is ₹ 20 = 4,00,000 ÷ 10 = 40,000 units
When S.P. is ₹ 18 = 4,00,000 ÷ 8 = 50,000 units
When S.P. is ₹ 26 = 4,00,000 ÷ 16 = 25,000 units

KEY TERMS

Cost-volume-profit (CVP) analysis is a powerful tool of profit planning based on "the study of the effects on future profits of changes in fixed cost, variable cost, sales price, quantity and mix."

Break even analysis. It is a widely used technique to study the CVP relationship

Contribution is the difference between selling price and variable cost.

P/V ratio shows the ratio of contribution to sales. It helps in calculating the break even point and also calculation of sales for achieving desired level of profit, etc.

Break even point is that level of sales where there is no profit and no loss.

Break even charts. It is a graphic presentation of break even analysis.

Margin of safety. It is the difference between actual sales and break even sales. A large margin of safety indicates that the business can still make profit when there is a serious fall in its sales.

Angle of incidence. It is an angle that is formed at the intersection of sales line and total cost line in a break even chart. A large angle of incidence indicates higher profitability.

Key factor. It is a factor in the activities of a undertaking which limits the volume of output at a particular point of time.

Cost Indifference Point It is a level of output where the total cost or profit of the alternatives is equal.

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EXAMINATION QUESTIONS

Objective Type Questioncs

True or False Statements. Give reason in brief.

1. Break even sales in ₹ × P/V ratio = Fixed cost.
2. Cost volume profit analysis assumes that sales volume does not change.
3. When break-even point is reached, after that contribution on additional sales is equal to profit.
4. Actual sales × P/V ratio × M/S ratio = Profit.
5. Profit is the difference between sales and contribution.
6. In a break-even chart, on X-axis production or sales may be represented.
7. At break-even point, fixed cost is equal to contribution.
8. Margin of safety can be improved by lowering fixed cost.
9. In a break-even chart, angle of incidence is formed at the intersection of sales line and variable cost line.
10. Break-even chart does not show profit or loss at various levels of sales.
11. Profit volume ratio does not change if there is a change in sales value.
12. When selling price is reduced, P/V ratio is also reduced.

[Ans. 1. True, 2. False 3. True 4. True 5. False 6. True 7. True 8. True 9. False 10. False 11. True 12. True]

Fill in the blanks:

1. When fixed cost is ₹ 5 lakhs, P/V ratio is 40%, then the break-even point is ₹....
2. When B.E. point is ₹ 5 lakhs and M/S is 37.50%, then total sales are ₹.....
3. Break-even sales are 1000 units, fixed cost ₹ 2,000, contribution per unit is ₹.....
4. When sales increase from ₹ 20,000 to 40,000 while profit increase from ₹ 1,000 to ₹ 2,000, P/V ratio is.....
5. Fixed cost is ₹ 2000 and variable cost is 60% of sales, the break-even point is ₹.....
6. Break-even point is ₹ 10,000, the fixed cost is ₹ 3,000, P/V ratio is .....
7. Fixed cost ₹ 4,000, Profit ₹ 1,000, break-even sales ₹ 20,000, the P/V ratio is.....
8. Profit is 10% of sales, margin of safety is 40%, P/V ratio is .....
9. Break-even point is ₹ 10,000, contribution to sales ratio is 20%, the fixed cost is ₹ .....
10. When B.E. point is ₹ 20,000 and margin of safety is 20%, actual sales are ₹.....
11. Contribution per unit is ₹ 5 and B.E. Point 4,000 units, the fixed cost is ₹.....
12. When contribution is ₹ 15,000, P/V ratio 40%, the sales is ₹.....

[Ans. 1. 12,50,000; 2. 8,00,000; 3. 2; 4. 5%; 5. 5000; 6. 30%; 7. 20%; 8. 25%; 9. 2,000; 10. 25,000; 11. ₹ 20,000; 12. ₹ 37,500.]

Essay Type Questions

1. What is break-even point ? What are the limitations of break-even analysis ? (*B.Com. Hons. Delhi*)
2. What is P/V ratio? Explain its uses. (*B.Com., Mysore*)
3. What do you understand by (*a*) Break-even point, and (*b*) Break-even chart? (*B.Com., Kerala*)
4. What do you understand by break-even analysis? Explain its uses. (*B.Com. Hons., Delhi*)
5. What do you understand by contribution? How is it related to profit? (*B.Com., Andhra*)
6. State briefly the effect of the following on break-even point and profit volume ratio:
   (*i*) Reduction in variable cost ratio.
   (*ii*) Increase in total fixed cost.
   (*iii*) Increase in price of the product.
   (*iv*) Increase in quantity of sales. (*B.Com.*)
7. Explain the ways by which P/V ratio can be improved. (*M.Com., Kerala*)
8. Explain the following terms :
   (*a*) Key factor (*b*) P/V ratio
   (*c*) Marginal of safety (*d*) Angle of incidence (*B.Com.*)
9. What is meant by break-even analysis. Discuss assumption of the technique. (*B.Com. Hons., Delhi*)
10. "Break-even analysis is fundamentally on a static analysis." Discuss and explain the limitations of the concept. (*I.C.W.A., Inter*)
11. "Break-even analysis is based on a simplified model of a business which is unrealistic" Explain and give your views. (*M.Com.*)
12. (*a*) Break-even analysis assumes that variable costs and revenues are linear and that fixed costs are fixed. Briefly describe why these assumptions may not be realistic.
    (*b*) Can there be two break even points? Discuss. (*B.Com. Hons., Delhi*)
13. "The effect of price reduction is always to reduce P/V ratio, raise the break-even point and shorter the margin of safety." Explain and illustrate with assumed figures. (*M.Com., Bangalore*)
14. Explain the significance and objective of a break-even chart and state the factors which would cause the break-even point to change. (*C.A. Inter*)
15. Enumerate the steps required to improve the margin of safety. (*C.A. Inter*)
16. What is meant by angle of incidence and margin of safety and show these in a break-even chart. Explain. (*B.Com. Hons., Delhi*)

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Practical Questions

1. Find out the break-even point :

Variable cost	₹	6,00,000
Fixed cost	₹	3,00,000
Net Profit	₹	1,00,000
		10,00,000

(B.Com., Madras)

[**Ans.** ₹ 7,50,000]

2. A company annually manufactures and sells 20,000 units of a product, the selling price of which is ₹ 50 and profit earned is ₹ 10 per unit.

The analysis of cost of 20,000 units is :

Materials cost	₹ 3,00,000
Labour Cost	₹ 1,00,000
Overheads	₹ 4,00,000 (50% variable)

You are required to compute :

(*i*) Break-even sales in units and in Rupees.

(*ii*) Sales to earn a profit of ₹ 3,00,000.

(*iii*) Profit when 15,000 units are sold.

[**Ans.** (*i*) 10,000 units or ₹ 5,00,000 (*ii*) ₹ 12,50,000; (*iii*) ₹ 1,00,000]

3. You are given the following information:

	₹
Fixed cost	4,000
B.E. Sales	20,000
Profit	1,000
Selling price (per unit)	20

Calculate (*a*) Sales and marginal cost of sales

(*b*) New B.E. Point if selling price is reduced by 10%. *(B.Com. Delhi)*

[**Ans.** Sales ₹ 25,000; Marginal cost ₹ 20,000; New B.E.P. ₹ 36,000]

4. From the following data, you are required to calculate the break-even point and net sales value at this point :

Selling price per unit	₹ 25
Direct material cost per unit	8
Direct labour cost per unit	5
Fixed overheads	24,000
Variable overheads @ 60% on direct labour	
Trade discount	4%

If sales are 15% and 20% above the break-even volume, determine the net profits.

(C.S. Inter)

[**Ans.** B.E.P. 3000 units, Profit (*i*) ₹ 3,600, (*ii*) ₹ 4,800]

5. You are given the following information:

	₹
Selling price per unit	20
Variable cost	12
Total fixed cost	96,000

Calculate :

(*i*) Break-even units and value.

(*ii*) Profit and margin of safety when sales would be ₹ 4,00,000

(B.Com., Punjab)

[**Ans.** (*i*) 12,000 units, ₹ 2,40,000 (*ii*) Profit ₹ 64,000, Margin of safety ₹ 1,60,000]

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6. Sales 10,000 units @ ₹ 20 per unit.
Variable costs ₹ 10 per unit.
Fixed cost (total) ₹ 50,000
Find out (*i*) B.E. Point in units
(*ii*) Profit earned
(*iii*) Sales required to earn a profit of ₹ 60,000

(B.Com., Adapted)

[Ans. (*i*) 5,000 units; (*ii*) ₹ 50,000; (*iii*) 11,000 units]

7. You are given:
Margin of Safety = ₹ 10,000 which represent 40% of sales. P/V Ratio = 50%
Find out:
(*a*) Break-even sales (*b*) Fixed cost,
(*c*) Total sales, and (*d*) Profit

(B.Com., Osmania)

[Ans. (*a*) ₹ 15,000, (*b*) ₹ 7,500, (*c*) ₹ 25,000, (*d*) ₹ 5,000]

8. A company budget for a production of 1,50,000 units. The variable cost per unit is ₹ 14 and fixed cost is ₹ 2 per unit. The company fixes its selling price to fetch a profit of 15% on cost.
(*a*) What is the break-even point?
(*b*) What is the profit volume ratio?
(*c*) If it reduces its selling price by 5%, how does the revised selling price affect the break-even point and the profit volume ratio?
(*d*) If a profit increase of 10% is desired more than the budget, what should be the sales at the reduced prices?

(B.Com. Hons. Delhi)

[Ans. (*a*) 68,182 units (*b*) 23.91%, (*c*) BEP 86,207 units, P/V ratio 19.9% (*d*) ₹ 34,96,000]

9. A company earned a profit of ₹ 30,000 during the year 2004-05. If the marginal cost and selling price of a product are ₹ 8 and ₹ 10 per unit respectively, find out the amount of 'Margin of Safety'.

(C.A. Inter)

[Ans. ₹ 150,000]

10. (*i*) Ascertain profit when sales = ₹ 2,00,000, Fixed cost = ₹ 40,000,
Break-even point = ₹ 1,60,000.
(*ii*) Ascertain sales, when fixed cost ₹ 20,000, Profit = ₹ 10,000, Break-even point is ₹ 40,000.

(C.A., Inter)

[Ans. (*i*) ₹ 10,000; (*ii*) ₹ 60,000]

11. The Profit/Volume ratio of a company is 50% and its margin of safety is 40%. You are required to work out the break-even point and the net profit if sales volume is ₹ 50 lakhs. *(B.Com. Hons., Delhi)*

[Ans. BEP ₹ 30 lakhs, Profit ₹ 10 lakhs]

12. (*a*) From the following particulars draw a break-even chart and find out the break-even point.

Variable cost per unit	₹ 15
Fixed cost	₹ 54,000
Selling price unit	₹ 20

(*b*) What should be the selling price if break-even point is to be brought down to 6,000 units.

(B.Com., Bangalore)

[Ans. (*a*) 10,800 units; (*b*) ₹ 24]

13. SK + F Ltd., manufactured and sold 1,000 Electric Irons last year at a price of ₹ 800 each. The cost structure of Electric Irons :

Materials	200
Labour	100

Variable cost	50
Marginal cost	350
Factory overheads (fixed)	200
Total cost	550
Profit	250
Sale price	800

Due to heavy competition, price had to be reduced to ₹ 750 for the coming year. Assuming no change in costs, state the number of Electric Irons that would have to be sold at the new price to ensure the same amount of total profit as that of the last year. *(B.Com. Hons., Delhi)*

[Ans. 1,125 Irons]

14. The trading results of a company for two periods are as under:

	Sales ₹	*Profit* ₹
Period I	1,30,000	6,000
Period II	1,50,000	10,000

Calculate : (*a*) P.V. Ratio; and (*b*) B.E.P. *(B.Com., Calicut)*

[Ans. (*a*) 20%, (*b*) ₹ 1,00,000]

15. The operating results of a company for the last two years are as follows:

	Sales	*Profit*
Year 2017	₹ 2,70,000	₹ 6,000
Year 2018	₹ 3,00,000	₹ 15,000

You are required to calculate:

(*a*) P/V Ratio

(*b*) Break-even point.

(*c*) Margin of safety at a profit of ₹ 24,000. *(B.Com., Madras)*

[Ans. (*a*) 30%, (*b*) ₹ 2,50,000, (*c*) ₹ 80,000]

16. The sales and profit during two years are given below:

	Sales	*Profit*
Year 2017	₹ 20 lakhs	₹ 2 lakhs
Year 2018	₹ 30 lakhs	₹ 4 lakhs

Calculate (*a*) P/V ratio, (*b*) Sales required to earn a profit of ₹ 5 lakhs. *(I.C.W.A. Inter)*

[Ans. (*a*) 20%; (*b*) ₹ 35 lakhs]

17. The sales and profit for two years are as below:

	Sales (₹)	*Profit* (₹)
Year 2017	1,50,000	20,000
Year 2018	1,70,000	25,000

Calculate:

(*a*) P/V ratio, (*b*) B.E.P. (*c*) Sales required to earn a profit of ₹ 40,000. (*d*) Margin of safety at a profit of ₹ 1,25,000 (*e*) Profit made when sales are ₹ 1,00,000. (*f*) Variable costs of the two years. *(B.Com., Madurai)*

[Ans. (*a*) 25%, (*b*) ₹ 70,000, (*c*) 2,30,000, (*d*) ₹ 5,00,000, (*e*) ₹ 7,500, (*f*) ₹ 1,12,500 and ₹ 1,27,500]

18. The Reliance Co. furnishes you the following information

	Year 2017	
	First half	*Second half*
Sales	₹ 8,10,000	10,26,000
Profits	₹ 21,600	64,800

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From the above you are required to compute the following assuming that fixed cost remains the same in both the periods.

1. P/V ratio
2. Fixed cost
3. The amount of profit or loss when sales are ₹ 6,48,000
4. The amount of sales required to earn a profit of ₹ 1,08,000. *(B.Com. Hons., Delhi)*

[Ans. (1) 20%; (2) ₹ 1,40,400; (3) ₹ 10,800 Loss; (4) ₹ 12,42,000]

19. The trading result of *PJ* Ltd. for the two years have been :

Year	*Sales* ₹	*Profit* ₹
2017	5,40,000	12,000
2018	6,00,000	30,000

Computate the following :

(*i*) P/V ratio;
(*ii*) Fixed costs;
(*iii*) Break-even sales;
(*iv*) Margin of safety at a profit of ₹ 48,000; and
(*v*) Variable costs during the two years. *(B.Com Hons., Delhi)*

[Ans. (*i*) 30%; (*ii*) ₹ 1,50,000; (*iii*) ₹ 5,00,000; (*iv*) ₹ 1,60,000; (*v*) 3,78,000 and ₹ 4,20,000]

21. The sales turnover and profit of M/s A Ltd. during the two year were as follows :

Year	*Sales* ₹	*Profit* ₹
2017	4,50,000	60,000
2018	5,10,000	75,000

You are required to calculate :

(*i*) Profit-Volume ratio;
(*ii*) Sales at which company will neither lose nor gain anything;
(*iii*) Sales required to earn a profit of ₹ 1,20,000;
(*iv*) The profit made when sales are ₹ 7,50,000. *(B.Com., Delhi)*

[Ans. (*i*) 25%; (*ii*) ₹ 2,10,000; (*iii*) ₹ 6,90,000; (*iv*) ₹ 1,35,000]

22. A company has a fixed cost of ₹ 20,000. It sells two products—*A* and *B*, in the ratio of 2 units of *A* and 1 unit of *B*. Contribution is Re.1 per unit of *A* and ₹ 2 per unit of *B*. How many units of *A* and *B* would be sold at break-even point? *(B.Com. Hons., Delhi)*

[Ans. A—10,000 units, B—5,000 units]

23. A company having annual sales of ₹ 10 crores is earning 12% profit before charging interest and depreciation. Interest and depreciation amount to ₹ 60 lakhs and ₹ 100 lakhs respectively. If the contribution/sales ratio of the company is 0.4, calculate its break-even sales.*(B.Com. Hons., Delhi)*

[Ans. ₹ 11 crores]

(**Hint** : Loss ₹ 40 lakhs; Fixed cost ₹ 4.4 crores).

24. *R K* Ltd. manufactures three products *X*, *Y* and *Z*. The unit selling prices of three products are ₹ 100, ₹ 160 and ₹ 75 respectively. The corresponding unit variable costs are ₹ 50, ₹ 80 and ₹ 30. The proportions (quantity) in which these products are manufactured and sold are 20%, 30% and 50% respectively. The total fixed costs are ₹ 14,80,000.

Calculate the overall break-even quantity and the productwise break-up of such quantity. *(C.A. Inter)*

[Ans. Overall BEP = 26,195 units, *X*—5,239 units, *Y*—7,858 units, *Z*—13,098 units]

25. Electronics India Ltd., decides to effect 10% reduction in the prices of its products because it is felt that such a step may lead to greater volume of sales.

It is anticipated that there are no prospects of a change in total fixed and variable costs per unit. The directors wish to maintain net profits at the present level.

The following information has been obtained from its books:

Sales—10,000 units	₹ 2,00,000
Variable costs—₹ 15 per unit	
Fixed cost	₹ 40,000

How would the management proceed to implement this decision? (*B.Com. Hons., Delhi*)

[**Ans.** Sales required to earn current amount of profit ₹ 3,00,000]

26. Graphics Ltd. manufactures a document reproducting machine which has a variable cost structure as follows:

Material	₹ 40
Labour	₹ 10
Overhead	₹ 4

and a selling price of ₹ 90.

Sales during the current year are expected to be ₹ 13,50,000 and fixed cost ₹ 1,40,000. Under a wage agreement, an increase of 10% is payable to all direct workers from the beginning of the forthcoming year, whilst material costs are expected to increase by 7.5%, variable overhead costs by 5% and fixed overhead costs by 3%.

You are required to calculate:

(*a*) The new selling price if the current Profit/Volume Ratio is to be maintained; and

(*b*) The quantity to be sold during the forthcoming year to yield the same amount of profit as the current year assuming the selling price to remain at ₹ 90. (*C.A., Inter*)

[**Ans.** (*a*) ₹ 97; (*b*) ₹ 17,113 machines]

(**Hint** : (*a*) New SP = $\frac{58.20}{54} \times 90 = ₹\ 97$

(*b*) New sales quantity = $\frac{1,44,200 + 4,00,000}{31.80} = 17,113$)

27. Heina supply you the following information:

Fixed overhead	₹ 1,80,000
Variable cost per unit	₹ 2
Selling price unit	₹ 20

You are required to calculate:

(*a*) Break-even point,

(*b*) Sale required to earn a profit of ₹ 72,000.

(*c*) Margin of safety when profit is ₹ 72,000. (*B.Com.*)

[**Ans.** (*a*) 10,000 units; (*b*) 14,000 units; (*c*) 4,000 units]

28. The "Containers and Cases Private Limited" produces and markets industrial containers and packing cases. Due to competition the company proposes to reduce the selling price. If the present level of profit is to be maintained, indicate the number of units to be sold if the proposed reduction in selling price is: (*a*) 5% (*b*) 10% and (*c*) 15%.

The following additional information is available:

	₹	₹
Present sales turnover (30,000 units)		3,00,000
Variable cost (30,000 units)	1,80,000	
Fixed cost	70,000	2,50,000
Net Profit		50,000

[**Ans.** (*a*) 34,286; (*b*) 40,000; (*c*) 48,000]

29. An analysis of Sultan Manufacturing Company led to the following information:

Cost element	Variable cost (% of sales)	Fixed cost ₹
Direct material	32.8	–
Direct labour	28.4	–
Factory overhead	12.6	1,89,900
Distribution overhead	4.1	58,400
General administration overhead	1.1	66,700

Budgeted sales for the next year ₹ 18,50,000. You are required to determine:

(*a*) Break-even sales value.
(*b*) Profit at the budgeted sales volume.
(*c*) Profit, if actual sales:
(*i*) drop by 10%
(*ii*) increase by 5% from the budgeted sales.

(B.Com. and B.Com. Hons., Delhi)

[Ans. (*a*) 15,00,000, (*b*) 73,500; (*c*) (*i*) ₹ 34,650, (*ii*) ₹ 92,925]

(Hint : Variable cost is 79% of sales. Thus P/V ratio is 100 – 79 = 21%).

30. S.N. Ltd. Furnishes the following information relating to the half.year ended 30 June, 2005.

Fixed cost	₹ 45,000
Sales	₹ 1,50,000
Profit	₹ 30,000

During the second half of the year, the company has projected a loss of ₹ 10,000. Calculate:

(*a*) The break-even point and margin of safety for the six month ending 30 June, 2005.
(*b*) Expected sales volume for the second half of the year assuming that fixed costs and P/V ratio remain constant in the second half of the year.
(*c*) The break-even point and margin of safety for the whole year of 2005.

(C.A. Inter)

[Ans. (*a*) ₹ 90,000, ₹ 60,000; (*b*) ₹ 70,000; (*c*) ₹ 1,80,000; ₹ 40,000]

31. The budgeted sales of three products of a company are as follows:

	Products		
	X	*Y*	*Z*
Budgeted sales in units	10,000	15,000	20,000
Budgeted selling price per unit	₹ 4	4	4
Budgeted variable cost per unit	₹ 2.5	3	3.5
Budgeted fixed expenses (total)	₹ 12,000	9,000	7,500

From the above information you are required to compute the following for each product:

(*a*) The budgeted profit.
(*b*) The budgeted break-even sales.
(*c*) The budgeted margin of safety in terms of sales value.

(B.Com., Adapted)

[Ans. (*a*) ₹ 3,000; ₹ 6,000; ₹ 2,500, (*b*) ₹ 32,000; ₹ 36,000; ₹ 60,000
(*c*) ₹ 8,000 or 20%, ₹ 24,000 or 40%; ₹ 20,000 or 25%]

32. There are two factories under the same management. The management desires to merge these two plants. The following particulars are available:

	Factory I	*Factory II*
Capacity operation	100 per cent	60 per cent
Sales	₹ 300 lakhs	₹ 120 lakhs
Variable costs	₹ 220 lakhs	₹ 90 lakhs
Fixed costs	₹ 40 lakhs	₹ 20 lakhs

You are required to calculate (*i*) what would be the capacity of the merged plant to be operated for the purpose of breaking even, and (*ii*) what would be the profit on working at 75 per cent of the merged capacity. (*C.A. Inter*)

[**Ans.** (*i*) 46.15% or ₹ 230.77 lakhs; (*ii*) ₹ 37.5 lakhs]

33. Goa Chemicals Ltd. produces the following income statement for the previous year. Except as noted, the cost revenue relationship for the coming year is expected to follow the same pattern as in the proceeding year. Income statement for the year ending 30 June, 2005 is as follows:

Sales (20,00,000 units @ 25 paise each)		₹ 5,00,000
Variable cost	3,00,000	
Fixed cost	1,00,000	4,00,000
Per-tax profit		1,00,000
Income tax		50,000
Profit after tax		50,000

You are required to:

(*a*) Find out break-even point.

(*b*) Find out the number of bottles to be sold to break-even after plant expansion which adds ₹ 50,000 to fixed cost and increases capacity by 60%.

(*c*) Find out the level of sales at which the company will be able to maintain its present pre-tax profit position even after expansion.

(*d*) Find out the profit when plant operates at full capacity after the expansion.

[**Ans.** (*a*) 2,50,000 or 10,00,000 units; (*b*) ₹ 3,75,000 or 15,00,000 units; (*c*) ₹ 6,25,000; and (*d*) per-tax profit ₹ 1,70,000]

34. Leela Hotel has annual fixed cost applicable to rooms of ₹ 15,00,000 for a 300 rooms hotel with average daily rates of ₹ 40 and average variable cost of ₹ 6 for each room rented. The Hotel operates 365 days per year. It is subject to an income tax rate of 30 per cent.

It is required to :

(*a*) Compute the break-even point in terms of number of rooms rented, and

(*b*) Calculate the number of rooms the Hotel must rent to earn a net income after tax of ₹ 10,00,000. (*B.Com. Hons., Delhi*)

[**Ans.** (*a*) 44,118 rooms per year or 121 rooms per day, (*b*) 86,134 rooms per year or 236 rooms per day]

(**Hint** : Rooms to earn given profit $= \dfrac{₹\,15,00,000 + \left[\dfrac{10,00,000}{70\%}\right]}{₹\,34} = 86,134.$

35. The following is budget for the year 2017

	₹
Sales (1,00,000 units @ ₹ 20)	20,00,000
Variable cost	10,00,000
Contribution	10,00,000
Fixed cost	4,00,000
Net profit	6,00,000

From the above set of information find out:

(*a*) The adjusted profits for 2017 if the following two sets of changes are introduced and also suggest which plan should be implemented.

Plan A		*Plan B*	
Increase in price	20%	Decrease in price	20%

Decrease in volume	25%	Increase in volume	25%
Increase in variable cost	10%	Decrease in variable cost	10%
Increase in fixed cost	5%	Decrease in fixed cost	5%

(*b*) The P/V ratio and break-even points under the two plans referred above. (*I.C.W.A., Inter*)

[**Ans.** Plan *A* — Profit ₹ 5,55,000, P/V ratio 54.167%, BEP ₹ 7,75,384
Plan *B* — Profit ₹ 4,95,000, P/V ratio 43.75%, BEP ₹ 8,68,572
Original profit is higher at ₹ 6,00,000 and thus Plan *A* and *B* should not be implemented)

36. *ABC* Ltd. manufactures and markets a single product. The following data are available:

Materials	₹ 16 per unit
Conversion (variable) cost	12 per unit
Dealer's margin (10% of selling price)	4 per unit
Selling price	40 per unit

Fixed cost: ₹ 5 lakhs.
Present sales: 90,000 units.
Capacity utilisation: 60 per cent.

There is acute competition. Extra efforts are necessary to sell, Suggestions have been made for increasing the sales:

(*a*) By reducing sales price by 5 per cent.

(*b*) By increasing dealer's margin by 25 per cent over the existing rate.

Which of these suggestions you would recommend, if the company desires to maintain the present profit? Give reasons. (*M.Com., Kerala*)

[**Ans.** Present contribution ₹ 7,20,000, profit ₹ 2,20,000; (*b*) suggestion is recommended]

37. Two firms *A* & Co. and *B* & Co. sell the same type of product in the same market. Their budgeted Profit & Loss Accounts for the year ending 31st March, 2018 are as follows :

	A & Co.		*B* & Co.	
	₹	₹	₹	₹
Sales		5,00,000		6,00,000
Variable costs	4,00,000		4,00,000	
Fixed costs	30,000	4,30,000	70,000	4,70,000
Net Profit		70,000		1,30,000

Required :

1. Calculate at which sales volume both the firms will earn equal profit.
2. State which firm is likely to earn greater profit in condition of :
   (*i*) heavy demand for the product;
   (*ii*) low demand for the product. (*C.A. Inter*)

[**Ans.** 1. ₹ 3,00,000, 2. (*i*) Company *B* because its P/V ratio is higher, (*ii*) Company *A* because its P/V ratio is lower]

(**Hint :** Formula for computing sales where both A and B will earn equal profit = $\frac{\text{Difference in fixed cost}}{\text{Difference in P/V ratio}}$).

38. Two companies *AB* Ltd. and *XY* Ltd. produce and sell the same type of product in the same market. For the year ended March, 2018, their forecasted profit and loss accounts are as follows:

	AB Ltd.		XY Ltd.	
		₹		₹
Sales		2,50,000		2,50,000
Less: Variable cost of sales	2,00,000		1,50,000	
Fixed cost	25,000	2,25,000	75,000	2,25,000
Profit		25,000		25,000

You are required to compute : (*a*) P/V ratio, (*b*) Break-even point, (*c*) State which company is likely to earn greater profit in conditions of (*i*) low demand (*ii*) high demand. (*B.Com. Bangalore, Delhi*)

[**Ans.** (*a*) 20%; 40%, (*b*) ₹ 1,25,000; ₹ 1,87,500, (*c*) (*i*) *AB* Ltd.; (*ii*) *XY* Ltd]

39. The following miscellanseous information regarding the operations of 2017 has been made available from the records of Acme Corporation:

	₹
Sales	1,00,000
Direct materials used	40,000
Direct labour	15,000
Fixed manufacturing overhead	20,000
Fixed selling and administration expenses	10,000
Gross profit	20,000
Net loss	5,000

There are no beginning or ending inventories.

It is required to calculate:

(*i*) Variable selling and administration expenses
(*ii*) Contribution margin in rupees
(*iii*) Variable factory overhead
(*iv*) Break-even point in rupee sales
(*v*) Factory cost of goods sold. (*B.Com. Hons., Delhi*)

[**Ans.** (*i*) ₹ 15,000; (*ii*) ₹ 25,000; (*iii*) ₹ 5,000; (*iv*) ₹ 1,20,000; (*v*) ₹ 80,000]

40. (*a*) When sales of a company decline from ₹ 9,00,000 to ₹ 7,00,000, its profit of ₹ 50,000 is converted into a loss of ₹ 50,000. Determine contribution margin ratio.

(*b*) Sales at break-even point in a company is ₹ 25,000 and its fixed cost is ₹ 10,000. What is its total contribution? (*B.Com. Hons., Delhi*)

[**Ans.** (*a*) 50%, (*b*) ₹ 10,000]

41. The following information is supplied to you:

	₹
Fixed cost (total)	4,500
Variable cost (total)	7,500
Sales (total)	15,000
Units sold 5,000	

Calculate: (*a*) Contribution
(*b*) B.E. point in units
(*c*) Margin of safety
(*d*) Profit
(*e*) Volume of sales to earn a profit of ₹ 6000. (*I.C.W.A. Inter*)

[**Ans.** (*a*) ₹ 7,500; (*b*) 3,000 units; (*c*) ₹ 6,000; (*d*) ₹ 3,000; (*e*) ₹ 21,000]

42. Modern Sports Ltd. has for the past several years produced boxing gloves which are sold at ₹ 28 per pair. Higher costs in recent years have made management to consider about the adequacy of this selling price.

The labour rate was increased from ₹ 1.75 per hour to ₹ 2.25 per hour and the cost of leather has gone up from ₹ 1.10 to ₹ 2.15 per square foot during the last five years. Fixed expenses have increased 25% from the level of ₹ 18,000 five years ago. Over the same period variable overhead has increased 30%, or ₹ 3 per pair of gloves. Each glove requires 1.5 sq. ft. of leather and one hour of direct labour.

Calculate the selling price that the company has to charge under the new cost structure to break-even at the same number of units as five years ago. *(B.Com. Hons., Delhi)*

[**Ans.** New Selling price ₹ 37.95, New contribution ₹ 14 per unit, B.E. point 1607 units]

43. Taurus Ltd. produces three products—*A*, *B* and *C*—from the same manufacturing facilities. The cost and other details of the three products are as follows:

	A	*B*	*C*
Selling Price/unit (₹)	200	160	100
Variable cost/unit (₹)	120	120	40
Fixed expenses/month (₹) 2,76,000			
Maximum production per month (units)	5,000	8,000	6,000
Total hours available for the month 200.			
Maximum demand per month (units)	2,000	4,000	2,400

The processing hours cannot be increased beyond 200 hours per month.

You are required to:

(*a*) compute the most profitable product-mix; and

(*b*) compute the overall break-even sales of the company for the month based on the mix calculated in (*a*) above. *(C.A. Inter)*

[**Ans.** (*i*) *A*—2,000 units, *B*—1,600 units, *C*—2,400 units. (*ii*) ₹ 6,72,000]

44. The following figures relate to one year's working at 100% capacity level in a manufacturing business:

	₹
Fixed overhead	30,000
Variable overhead	50,000
Direct wages	40,000
Direct materials	1,00,000
Sales	2,50,000

Represent the above figures on a break-even chart and determine from the chart the break-even point. Verify your result by calculation. *(B.Com. Hons., Delhi)*

[**Ans.** ₹ 1,25,000]

45. This price structure of a cycle made by the Cycle Co. Ltd., is as follows:

	Per cycle ₹
Materials	60
Labour	20
Variable overheads	20
	100
Fixed overheads	50
Profit	50
Selling price	200

This is based on the manufacture of one lakh cycles per annum.

The company expects that due to competition they will have to reduce selling prices, but they want to keep the total profits intact. What level of production will have to be reached, i.e., how many cycles will have to be made to get the same amount of profits if:

(*a*) the selling price is reduced by 10%?

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(*b*) the selling price is reduced by 20%? (*B.Com., Madurai*)

[**Ans.** (*a*) 1,25,000; (*b*); 1,66,667]

46. From the following data which product would you recommend for manufacture in the factory?

	Per unit of	
	Product A	*Product B*
Standard manufacture time (hrs.)	2	3
Direct materials	50	50
Direct labour @ ₹ 10 per hour	20	30
Variable overhead @ ₹ 6 per hour	12	18
Selling price	200	240

Total machine hours available in the factory are 50,000. (*I.C.W.A., Inter*).

[**Ans.** Product *A* is recommended when machine time is the limiting factor]

47 *ABC* Company manufactures and markets three products *A*, *B* and *C*. All the three products are made from the same set of machines. Production is limited by capacity. From the data given below indicate priorities for products, *A*, *B* and *C* with a view to maximising profit.

	Product A	*Product B*	*Product C*
	₹	₹	₹
Material cost per unit	2.25	3.25	4.25
Labour cost per unit	0.50	0.50	0.50
Variable overhead per unit	0.30	0.45	0.71
Selling price per unit	5.00	6.00	7.00
Standard machine time required per unit (in minutes)	39	20	28

In the following year, the company faces extreme shortage of raw material. It is noted that 3 kg., 4 kg. and 5 kg. of material are required to produce one unit of *A*, *B* and *C* respectively. How would product priorities change? (*I.C.W.A., Inter*)

[**Ans.** Production priorities—When machine time is key factor *B*, *C*, *A*.
—When raw material is key factor *A*, *B*, *C*].

48. The Cost Accountant of Flex Limited found to his surprise that the actual profit for the period ending 30th June, was the same as budgeted in spite of realising 10% more than the budgeted selling prices. The following were the results:

	Budget	*Actual*
	₹	₹
Sales	5,00,000	8,25,000
Variable costs of sales	3,00,000	5,75,000
Fixed costs	1,00,000	1,50,000
Profit	1,00,000	1,00,000

You are required to assist the Cost Accountant in preparing the necessary explanation as to why the profit remained the same despite and increase in sales. (*B.Com. Hons. Delhi, C.A., Inter*)

[**Ans.** Increase in profit due to increase in sales is fully offset by decrease in profit due to increase in cost.)

[**Hint:** (A) Increase in profit (*i*) due to increase in selling price ₹ 75,000 (*ii*) due to increase in sales volume ₹ 1,00,000. (B) Decrease in profit (*i*) due to increase in variable cost ₹ 1,25,000 and (*iii*) due to increase in fixed cost ₹ 50,000].

49. Use the marginal costing based profit equation to indicate the difference in the volume of sales in a pure monopoly and a pure competitive situation to reach a profit target of ₹ 1,00,000 in both cases. Assume variable cost per unit as ₹ 100 and fixed cost as ₹ 50,000 in both the situations. Also

assume selling prices to be ₹ 250 and ₹ 150 under monopolistic and competitive conditions respectively.

(I.C.W.A., Inter)

[**Ans.** Monopoly 1,000 units, competitive conditions 3,000 units to get the profit of ₹ 1,00,000]

51. A retail dealer in garments is currently selling 24,000 shirts annually. He supplies the following details for the year ended 31st December, 2017:

	₹
Selling price per shirt	40
Variable cost per shirt	25
Fixed costs:	
Staff salaries for the year	1,20,000
General office costs for the year	80,000
Advertising costs for the year	40,000

As a cost accountant of the firm you are required to answer the following each part independently:

(*i*) Calculate the break-even point and margin of safety in sales revenue and number of shirts sold.

(*ii*) Assume that 20,000 shirts were sold in a year. Find out the net profit of the firm.

(*iii*) If it is decided to introduce selling commission of ₹ 3 per shirt, how many shirts would require to be sold in a year to earn a net income of ₹ 15,000.

(*iv*) Assuming that for the year 2018 an additional staff salary of ₹ 33,000 is anticipated, and price of a shirt is likely to be increased by 15%, what should be the break-even point in number of shirts and sales revenue?

(B.Com. Hons., Delhi)

[**Ans.** (*i*) BEP ₹ 6,40,000 or 16,000 shirts, M/S ₹ 3,20,000 or 8,000 shirts, (*ii*) Profit ₹ 60,000, (*iii*) 21,250 shirts, (*iv*) BEP ₹ 5,98,000 or 13,000 shirts].

52. Plot the following data on a graph, and determine the break-even point:

Direct labour	₹ 10 per unit
Direct materials	₹ 20 per unit
Variable overheads	100 % of direct wages
Fixed overheads	₹ 1,20,000
Selling price	₹ 100 per unit

[**Ans.** B.E. Point ₹ 2,40,000]

53. You are given the following data for the coming year of a factory:

Budgeted output	80,000 units
Fixed expenses	₹ 4,00,000
Variable expenses per unit	₹ 10
Selling price per unit	₹ 20

Draw a break-even chart showing the break-even point. If the selling price is reduces to ₹ 18 per unit what will be the new break-even point ?

(I.C.W.A., Inter)

[**Ans.** BEP ₹ 8,00,000, New BEP ₹ 9,00,000]

54. (*a*) Draw a break even chart form the following data:

Fixed cost	₹ 5,000
Selling price	₹ 20 per unit
Variable cost	₹ 10 per unit

Show profit and margin of safety when sales are ₹ 20,000.

(*b*) Draw another break even chart to show the effect of 20% decrease in fixed cost.

[**Ans.** (*a*) BEP ₹ 10,000; (*b*) ₹ 8,000]

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CHAPTER 6

DECISION MAKING

CHAPTER OUTLINE

Introduction; Short-term and Long-term decisions; Relevant costs and relevant revenues; Classification of costs for decision-making; Cost and non-cost factors in decision-making; Decision-making and variable costing; Fixation of selling prices; Exploring new markets; Export sales; Make or buy decisions; Product mix decisions; Plant shut-down decisions; Differential cost analysis vs. variable costing; Decision making and differential cost analysis; Adding or dropping a product line; Decision regarding further processing; Problems and solutions; Key terms; Examination questions.

Introduction

In any business, the basic function of management is to make decisions. Making decisions is to choose among two or more available alternatives. For example, the management may have to decide whether to raise the price of its product, lower it or leave it unchanged at its present level. It may have to decide whether to continue to sell its product at a loss in a falling market or shut down its operations for the time being. In a company, manufacturing television sets, the management may have to decide whether to make picture tubes within the company or to buy it from an outside supplier. Thus the management is continuously engaged in evaluating various alternatives and in selecting the best out of these. The decision to be taken will be affected by cost and other factors.

Short-term and Long-term Decisions

The focus of this chapter is on short-term decisions, such as :

(*i*) Whether to sell a product in the domestic market or export it,
(*ii*) Whether to make a component part inhouse or buy it from an outside supplier,
(*iii*) Whether to change the present product mix to make it more profitable, etc.

Most managers consider a decision as a short-term if it involves a period of one year or less. This cut off period is arbitrary but commonly used, though a better distinction is that long term decisions normally require substantial capital investment with implications for several future years. Moreover, short-term decisions are more easily reversed than long-term. For example, price of a product can always be changed according to market conditions, export sales can be stopped, if necessary, and so on.

Long-term decisions involve consideration of return in capital employed, discounted cash flow, etc. Such decisions are outside the scope of this book.

Relevant Costs and Relevant Revenues

When management makes decisions, it has to concentrate on only relevant costs and relevant revenues. Not all costs and revenues are relevant. The relevant costs and relevant revenues are those expected future costs and expected future revenues that differ under different alternative courses of action being considered. Cost and revenues that remain unaffected by a decision are obviously irrelevant and need not be considered when making a decision.

Thus relevant costs and relevant revenues should have two characteristics :

(*a*) The costs and revenues must relate to future, and

(*b*) They must differ among different alternative courses of action.

The focus is on the future because decision to be made affects only future. Nothing can be done to change the past. Management cannot change the cost of plant and machinery purchased in 2001. It can change future costs by its current decisions. Hence, relevant costs are future costs that will differ depending on the actions of the management. In one decision, a cost may be relevant but in another decision the same cost may not be relevant. For each decision, the management must decide which costs are relevant.

SPECIAL COSTS FOR DECISION MAKING

There are certain costs which are specially computed for use by the management for the purpose of decision-making. These costs may not be recorded in the books of account.

Sunk Costs

A sunk cost is a cost that has already been incurred and that cannot be changed by any decision made now or in the future. Such costs are not relevant for decision-making about the future. To illustrate the concept of such cost, assume that a firm has just paid ₹ 1,00,000 for a special purpose machine. Since the cost outlay has been made, ₹ 1,00,000 investment in the machine is a sunk cost. Even though afterwords the decision to buy the machine is found unwise, no amount of regret can relieve the company of its decision, nor any future decision can cause the costs to be avoided. Despite the fact that sunk costs, which are historical costs, are irrelevant for making decisions, they are frequently analysed in detail before decisions about future courses of action are made. For example, historical costs may affect future tax payments which will differ depending on the course of action selected by management. Moreover, an analysis of historical costs may provide information about how future costs will differ under alternative courses of action.

Sunk cost and irrelevant costs are not synonymous and one should understand the difference between these two. Not all irrelevant costs are sunk costs but all sunk costs are irrelevant. To take an example, in choosing from the two alternative methods of production, if direct material cost is the same under the two alternatives, it is an irrelevant cost. But direct material cost is not a sunk cost because it will be incurred in future and is a future cost. In the opinion of *Horngren*, a well known authority on the subject, *sunk cost has the same meaning as the past cost and all past costs are irrelevant.*

Differential (or Incremental) Costs

This cost may be regarded as the difference in total cost resulting from a contemplated change. In other words, differential cost is the increase or decrease in total cost that results from an alternative course of action. It is ascertained by subtracting the cost of one alternative from the cost of another alternative. The alternative choice may arise because of change in method of production, in sales volume, change in product mix, make or buy decisions, take or refuse decision, etc.

For differential cost analysis, we need to know the incremental revenues (the change in revenue) and incremental cost (the change in cost) arising from the decision.

Marginal Cost

Marginal cost is the additional cost of producing one additional unit. Marginal cost is the same thing as variable cost. Marginal costing (or variable costing) is a technique of charging only variable costs to products. Inventory is also valued at variable cost only. Fixed cost is treated as period cost and written off in Profit and Loss Account of the period. Marginal costing is also a very important analytical and decision- making tool in the hands of management. It helps in decisions like make or buy, pricing of products, selection of sales mix, etc. (The technique of marginal costing is discussed in this book in a separate chapter).

Imputed Costs

These are hypothetical costs which are specially computed outside the accounting system for the purpose of decision-making. Interest on capital invested is a common type of imputed cost. As interest on capital is usually not included in cost, it is considered necessary to take it into account when deciding about the alternative capital investment projects. The failure to consider imputed interest cost may result in an erroneous decisions. For example, project A requires a capital investment of ₹ 50,000 and project B ₹ 40, 000. Both the projects are expected to yield ₹ 10,000 as additional profit. Obviously, these two projects are not equally profitable since project B requires less investment and thus, it should be preferred. Similarly, rental value of building owned by a firm is also an imputed cost.

Opportunity Cost

An opportunity cost may be defined as the potential benefit that is lost or sacrificed when the selection of one course of action makes it necessary to give up competing course of action. In other words, an opportunity cost is the sacrifice involved in accepting an alternative under consideration. For example, a company has deposited ₹ 1 lakh in bank at 10% p. a. interest. Now, it is considering a proposal to invest this amount in debentures where the yield is 12% p. a. If the company decides to invest in debentures, it will have to forego bank interest of ₹ 10,000 p. a., which is the opportunity cost.

Opportunity cost is a pure decision-making cost. It is an imputed cost that does not require cash outlay and it is not entered in the accounting books.

Replacement Cost

This is the cost at which there could be purchased an asset identical to that which is being replaced. In simple words, replacement cost is the current market cost of replacing an asset. When the management considers the replacement of an asset, it has to keep in mind its replacement cost and not the cost at which it was purchased earlier. For example, a machinery purchased in 1995 at ₹ 10,000 is discarded in 2003 and a new machinery of the same type is purchased for ₹ 15,000. So the replacement cost of the machinery is ₹ 15,000.

Out-of-pocket Cost (Explicit Cost and Implicit Cost)

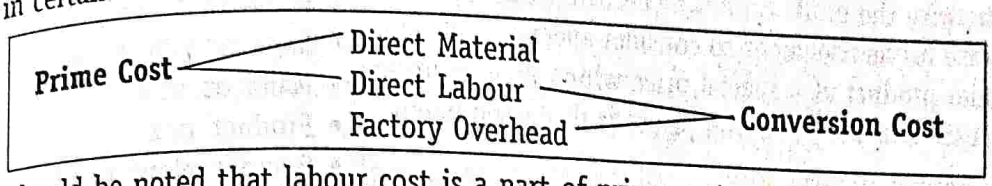
There are certain costs which require cash payment to be made (such a wages, rent) whereas many costs do not require cash outlay (such as depreciation). Out-of-pocket costs, also known as explicit costs, are those costs that involve cash outlays or require the utilisation of current resources. Examples of out-of-pocket costs are wages, material cost, insurance, power cost, etc. Out-of-pocket cost may be either fixed (manager's salary) or variable (raw materials and direct wages). Depreciation on plant and machinery does not involve any cash outlay and therefore is not an out-of-pocket cost. Such costs are also known as implicit costs. Out-of-pocket cost is frequently used as an aid in make or buy decision, price fixation during depression and many other decisions.

Future Cost

No decision can change what has already happened. The past is history and decisions made now can affect only what will happen in the future. Thus, the only relevant costs for decision-making are predetermined or future costs. But it is the historical costs which generally provide a basis for computing future costs. However, changing relationships in the future are also given due consideration while estimating future costs.

Conversion Cost

It is the total cost of converting' a raw material into finished product. This term is used to denote the sum of direct labour and factory overhead costs in the production of a product. In other words, conversion cost is the factory cost minus direct material cost. Appropriate use of this cost can be made in certain managerial decisions.



It should be noted that labour cost is a part of prime cost as well as conversion cost.

COST AND NON-COST FACTORS IN DECISION MAKING

In decision making, the management has to consider not only cost factors but also certain non-cost factors. Cost factors or quantitative factors are those which can be quantified in monetary terms. For example, in determining the selling price of a product, the cost of production of which is ₹ 100 per unit, the management will add, say 20% margin of profit and decide the selling price at ₹ 100 + 20 = ₹ 120 per unit. While the company is selling its product at ₹ 120 per unit, a competitor enters the market and starts selling the same product at ₹ 95 per unit. Now the company will incur a loss of ₹ 5 per unit if in order to compete, it sells the product at competitor's price because its own cost is ₹ 100 per unit. So, on cost considerations alone, the company should stop selling the product because selling results in a loss of ₹ 5 per unit. The management has to decide whether to sell at a loss or stop production of the product to avoid the loss.

In such a situation, it is difficult to make a decision on cost factors alone. It is essential that non-cost factors or qualitative factors be brought to the attention of the management in decision making process, since otherwise there is a danger of wrong decision being made. Non-cost factors are those which cannot be expressed in monetary terms with accuracy. For example, it may not be possible to quantify in monetary terms the effect of a decline in the morale of employees or loss of customer goodwill, if the company closes down the manufacturing facilities of a particular product.

Non-cost factors vary according to the decision under consideration. For example, a company plans to enter export business and it receives an export order at a price which is less than the own cost. On cost factors, the export order should be outrightly rejected because it does not cover even the cost. However, the management should consider the non-cost factors such as goodwill earned by the company for getting the export house status, earning valuable foreign exchange from the order and so on. For getting these benefits, the company should consider incurring a small and tolerable amount of loss, if it can afford it.

Variable Costing and Differential Costing as Aids in Decision Making

Variable or marginal costing and differential cost analysis are the two valuable techniques used for short-term business decisions.

DECISION-MAKING AND VARIABLE COSTING

The most useful contribution of variable costing is the assistance that it renders to the management in vital decision-making. This is to say that variable costing is an invaluable aid to management decision-making. Specific areas where variable costing proves its worth in decision-making are explained below:

1. Fixation of Selling Price

Although prices are regulated more by market conditions of demand and supply and other economic factors than by the decisions of management, the management while fixing prices has to keep in view the level of profit desired. In the long-run, the selling prices of products or services must be higher than the total cost as otherwise the profit cannot be earned. But frequently circumstances arise for management to consider special conditions and sell its regular product at a special price which may be lower than the total cost. Fixation of selling prices is discussed below :

Variable costing aids in decisions such as :
- Fixation of selling prices
- Exploring new markets
- Make or buy
- Product mix
- Operate plant or shut down.

(*a*) Under normal circumstances.
(*b*) In times of competition and/or trade depression.

Selling prices under normal circumstance

In the long run, under normal circumstances, the selling price must cover total cost (*i.e.*, variable cost plus fixed cost) and also give a reasonable amount of profit. This is essential for the survival of a business.

In the short run due to adverse market conditions, the selling price may have to be fixed below total cost but it should be above variable cost. In other words , the selling price may be temporarily fixed at marginal cost plus contribution basis and the amount of contribution depends upon demand and supply, acuteness of competition, non-cost factors etc. But it should be noted that fixation of selling price below total cost may be made only on a short term basis.

Pricing in competition and depression

When there is acute competition or in periods of depression, products may have to be priced below total cost, if such a step is necessary to meet the special situation. When variable cost technique is used for pricing, the price should be higher than the variable cost so that it makes a contribution towards fixed cost and help reduce the loss. When price is just equal to variable cost, the amount of loss will also be equal to the amount of fixed cost because in such situations the selling prices make no contribution towards fixed cost.

Thus, under special circumstances like the trade depression or competition, if selling price is higher than variable cost, even though it is below total cost, the production should not be stopped. This is because fixed costs will have to be incurred irrespective of whether production is continued or not, and continuing the production will help in reducing the amount of loss.

As a note of caution, fixation of selling price below total cost should be made only on a short-term basis. Pricing based on variable cost plus contribution helps companies to take advantage of short-term opportunities. But at the same time, no firm can afford to incur loss on a long-term basis and thus in the long-run, the selling price must cover total cost and give a reasonable amount of profit.

Example

Fixed cost	₹ 1,00,000 (total)
Variable cost	₹ 7 per unit

Current market price ₹ 8 per unit
Output 50,000 units.
Should company sell or not?

Solution

Variable cost (50,000 units @ ₹ 7)	₹ 3,50,000
Fixed cost	1,00,000
Total cost	4,50,000

Cost per unit = ₹ 4,50,000 ÷ 50,000 units = ₹ 9

Although the selling price does not cover the total cost, yet it is wise to continue to produce and sell because such a step will reduce the loss (on account of fixed cost) that will be incurred if production is stopped. If production is stopped, the loss would be ₹ 1,00,000 (the amount of fixed cost), but if production is continued the loss will be as follows:

Sales (50,000 units @ ₹ 8)	₹ 4,00,000
Less: Total cost (Marginal cost + Fixed cost)	₹ 4,50,000
Loss	₹ 50,000

Thus, by continuing to produce and sell at below total cost, the loss is reduced by ₹ 50,000, *i.e.*, from ₹ 1,00,000 to ₹ 50,000.

Special Circumstances when Selling Price is Below Variable Cost

When selling price falls below variable cost, the loss will be more than the amount of fixed cost. In such an eventuality, it will be better to stop production so as to reduce the amount of loss because stoppage in production means loss will be just equal to fixed cost.

However, in certain special circumstances like the following, production may be continued even if the selling price is below the marginal cost.

1. To popularise a new product. A new product introduced in the market may be sold at a very low price so as to make it popular.
2. To eliminate competitors from the market.
3. To dispose of perishable products so as to avoid total loss.
4. To export so as to earn foreign exchange. Government may allow import quota against foreign exchange earnings and profit from import quota may be more than the loss on exporting the product at low prices.
5. To keep plant and machinery in operation as idle machines may be liable to deterioration.
6. To prevent loss of future orders as temporary closure may break business connections with customers that can be re-established at a heavy expenditure.
7. To help in the sale of a conjoined product which is making large profits.
8. To maintain production and to keep employees occupied.

2. Exploring New Markets

Sometimes, a company is not able to fully utilise plant capacity when selling at total cost plus profit basis. In such a case, it may explore new markets and find opportunities to receive additional bulk order or export order at a price which may be below total cost but above variable cost so that the price makes a 'contribution'. The entire amount of contribution form such sales is profit because fixed cost is already recovered from current sales at total cost plus profit basis. Such additional sales at below total cost is possible only because in accepting bulk orders and export sales, price discrimination is possible. In this way spare plant capacity can be utilised to earn additional profit.

Additional Order for Utilising Spare Capacity

When a company has a spare (or idle) capacity which it is not able to utilise because of sales

constraint and it receives a bulk order at below normal selling price, such an order should be accepted, provided existing sales are not affected by price discrimination. It will earn the company additional profit, by utilising spare capacity.

Illustration 6.1

A manufacturer of plastic buckets makes an average profit of ₹ 2.50 per piece on a selling price of ₹ 14.50 by producing and selling 60,000 pieces at 60% of potential capacity. His cost of sales is:

	₹ per piece
Direct materials	4.00
Direct wages	1.00
Factory overhead (variable)	3.00
Selling overhead (variable)	0.25
Total fixed cost is ₹ 2,25,000	

During the current year, he intends to produce the same number of units, but anticipates that (*a*) fixed cost will go up by 10%, and (*b*) material and labour costs will go up by 5% each.

Under these circumstances, he obtains an offer for a further 20% of his capacity. What minimum price you would recommend for acceptance to ensure an overall profit of ₹ 1,60,000.

Solution

Budgeted Statement for the Current Year Prior to Acceptance of 20% Capacity Order

	Per piece ₹	*Total* ₹
Sales (60,000 pieces)	14.50	8,70,000
Direct material (₹ 4 + 5%)	4.20	2,52,000
Direct labour (Re 1 + 5%)	1.05	63,000
Variable factory overhead	3.00	1,80,000
Variable selling overhead	0.25	15,000
Variable cost	8.50	5,10,000
Contribution (Sales – Variable cost)	6.00	3,60,000

Fixed cost ₹ 2,25,000 + 10%	= ₹ 2,47,500	
Profit	= Contribution – Fixed cost	
	= 3,60,000 – 2,47,500 = ₹ 1,12,500	
Planned profit	= ₹ 1,60,000	
Increase in profit (or contribution) required	= 1,60,000 – 1,12,500 = ₹ 47,500	
Variable cost of additional 20,000 pieces (order for 20% capacity, *i.e.*, 20,000 × ₹ 8.50)	₹	1,70,000
Add: Additional contribution desired	₹	47,500
Total sales value	₹	2,17,500

Selling price per unit = ₹ 2,17,500 ÷ 20,000 units = ₹ 10.875

Thus, minimum price for sale of additional 20,000 units is ₹ 10.875 so as to ensure an overall profit of ₹ 1,60,000.

Export Sales

Additional orders may be accepted from a foreign market at below normal price or below total cost but above marginal cost. Export sales yield additional contribution when such sales are at a price which is above variable cost.

While determining profitability of accepting export orders, the following additional factors should be considered.

1. Export sales may result in additional costs like special packing cost, additional quality checks, freight and insurance charges, etc., if not borne by importer. These costs should be deducted from contribution to determine profit from export order.

2. Export sales may result in certain cost benefits like export subsidy from government, exemption or concessions in excise duty or duty drawbacks, etc. In determining profit from export order, these items should be deducted from cost or added in contribution.

Illustration 6.2

Indo-British Company has a capacity to produce 5,000 articles but actually produces only 2,000 articles for home market at the following costs.

		₹
Materials		40,000
Wages		36,000
Factory Overheads	— Fixed	12,000
	— Variable	20,000
Administration overhead	— Fixed	18,000
Selling and distribution overheads	— Fixed	10,000
	— Variable	16,000
	Total Cost	1,52,000

The home market can consume only 2,000 articles at a selling price of ₹ 80 per article. An additional order for the supply of 3,000 articles is received from a foreign country at ₹ 65 article. Should this order be accepted or not, if execution of this order entails an additional packing cost of ₹ 3,000.

Solution

Statement of Marginal Cost and Contribution
(of 3,000 articles for export)

		₹
	Materials @ ₹ 20 per article	60,000
	Wages @ ₹ 18 per article	54,000
	Variable overhead — Factory @ ₹ 10 per article	30,000
	— Selling and dist. @ ₹ 8 per article	24,000
	Marginal cost of sales	1,68,000
	Sales (3,000 articles @ ₹ 65)	1,95,000
	Contribution	27,000
Less:	Additional packing cost	3,000
	Additional profit	24,000

Acceptance of this export order results in additional profit of ₹ 24,000 and thus the order should be accepted.

Note: Fixed overhead have not been taken into account in deciding the acceptability of this order because fixed overhead have already been recovered from sale in the home market.

Non-Cost Factors or Qualitative Factors. Apart from cost and profit considerations, certain non-cost factors should also be kept in mind while making an exporting decision. These include :

(*a*) Foreign exchange earnings.

(*b*) Export house status.

(*c*) Enhancement in company prestige and goodwill, etc.

(*d*) Employment opportunities.

Conclusion

1. In normal times, prices should be based on total cost plus profit.

2. In market conditions like trade depression and competition, price may be fixed on marginal cost plus basis so as to make a contribution. This is valid only for a short period.

3. In order to utilise spare plant capacity, bulk orders from home market or from foreign market may be accepted at less than total cost but above marginal cost. This adds to the total profit of the company. This is possible only when price discrimination is such sales in different markets is possible.

3. Make or Buy Decisions (Insourcing Vs. Outsourcing)

Marginal cost analysis renders useful assistance when a decision has to be taken by the management on whether a component part should be manufactured internally or purchased from an outside firm. Insourcing is producing the goods by the firm itself whereas outsourcing is the process of purchasing the goods or services from outside suppliers. For example, a car manufacture may rely on outside vendors to supply some component parts but chooses to manufacture other parts internally.

This is particularly so when a component part is available in the market at a price below firm's own total cost. This type of decision based on total cost analysis may be misleading. Such a decision can be arrived at by comparing the outside supplier's price with firm's own marginal cost. On the face of it, since the only cost to manufacture the component is its marginal cost, then the amount by which marginal cost falls below supplier's price is the saving that arises in making. Therefore, it will be profitable to buy from outside only when supplier's price is below firm's own marginal cost.

For example, total cost of making a component is ₹ 100 per unit, consisting of ₹ 80 as variable cost and ₹ 20 as fixed cost. Suppose, an outside firm is prepared to supply this component at ₹ 90, it may appear that it is cheaper to buy the component. But a study of cost analysis will show that each unit if manufactured makes a contribution of ₹ 20 towards recovery of fixed cost. This fixed cost has to be incurred whether we make or buy. The real cost of making the component part is only ₹ 80 which is its variable cost. This offer of ₹ 90 per unit should not be accepted because if accepted, the component will really cost ₹ 110, *i.e.*, ₹ 90 of purchase price plus ₹ 20 of fixed cost which cannot be saved if component is not produced.

However, before arriving at final decision, due consideration should be given to other factors. For example, it should also be considered as to whether plant capacity released by the non-manufacture of the component part is put to some alternative use or not.

Illustration 6.3

A radio manufacturing co. finds that while it costs ₹ 6.25 to make component R-518, the same is available in the market at ₹ 5.75 each, with an assurance of continued supply. The break-down of the cost is :

	₹
Materials	2.75 each
Labour	1.75 each
Other variables	0.50 each
Depreciation and other fixed costs	1.25 each
	6.25

(a) Should you make or buy ?
(b) What would be your decision, if the supplier offered the component at ₹ 4.85 each ?
(*B.Com. Hons. Delhi*)

Solution.

The variable cost of producing the component is shown below :

	₹
Materials	2.75
Labour	1.75
Other variable costs	0.50
Variable or Marginal cost	5.00
Fixed cost	1.25

On the face of it, it appears that it is cheaper to buy the component at ₹ 5.75 each because it is less than own cost of ₹ 6.25 each but it should be understood that the fixed costs cannot be saved if it is decided to buy the component instead of making it. Thus if the component is purchased then it will really cost ₹ 7 per component i.e. ₹ 5.75 paid for purchase plus ₹ 1.25 of fixed cost which will continue to be incurred and cannot be saved. It is therefore, advised to make the component. But decision to make or buy will be influenced by the fact whether the capacity to be released by the non-manufacture of the component can be put to some alternative use or not, resulting in a saving of fixed cost. If yes, buying will be preferable as the component which costs ₹ 6.25 is available at ₹ 5.75. But if the released capacity cannot be utilised, it should not be purchased but made by the firm.

(b) If the price offered is ₹ 4.85 per unit, then the offer can be accepted as there will be a saving of 15 paise per unit even if the capacity released cannot be profitably employed. This is so because the price offered is less than the variable cost of the product.

Outsourcing and Idle Capacity. When a firm has no spare capacity and manufacturing a component involves setting aside other work, the loss of contribution of displaced work should also be given due consideration. In other work, it will be profitable to buy only when the purchase price is below variable cost plus loss of contribution of displaced work. The loss of contribution is usually best found by the use of contribution per unit of key factor.

Illustration 6.4

Manufacture of product *A* takes 20 hours on machine No. 101. It has a selling price of ₹ 150 and marginal cost of ₹ 110. Component part *Y* could be made on machine No. 101 in 4 hours. The marginal cost of component part is ₹ 9 of which outside supplier's price is ₹ 15.

Should one make or buy component *Y*. Discuss in both situations when—

(a) Machine No. 101 is working at full capacity.
(b) There is idle capacity.

Solution

(*a*) Contribution per unit of *A* = ₹ 150 – 110 = ₹ 40
Contribution per machine hour = ₹ 40 ÷ 20 hrs = ₹ 2 per hour.
If component *Y* in manufactured then as it takes 4 hours, the loss of contribution is ₹ 8 (*i.e.*, 4 hrs. @ ₹ 2). The total cost to make component *Y* will be ₹ 9 + ₹ 8 = ₹ 17.
This is more than supplier's price of ₹ 15 and so it is better to buy than to make component *Y*.
(*b*) If, however, there is some unutilised machine capacity, then there would be no loss of contribution and so the cost of making component *Y* would only be its variable cost, *i.e.*, ₹ 9. In such a case, it would be economical to make the product than buy it.

Non-cost or Qualitative Factors. While making a decision on make or buy a component, the following non-cost factors should also be considered.

(*a*) Assurance of continued supply, if bought from outside.
(*b*) Assurance of quality of the product by the supplier.
(*c*) Assurance of no price increase during the period of agreement.

4. Product Mix Decisions

Sales mix or product mix denotes the proportion in which various products are sold or produced. The problem of selecting a profitable mix of sales thus, arises only when a business enterprise has a variety of product lines and each making a contribution of its own. Any change in sales mix also results in the change in profit position. The technique of marginal costing helps the management in determining the most profitable sale mix.

The discussion on selection of the most profitable product mix may be discussed in two parts :
(*a*) When there is no key factor, and
(*b*) When there is a key factor.

(*a*) When there is no key (or limiting) factor

The concept of key factor was explained in the chapter on Cost Volume Profit Analysis. When there is no key factor, the product mix that provides the highest amount of *contribution* is considered as the most profitable sales mix. This holds good when fixed cost does not change due to changes in sales mix.

However, when changes in sales mix are associated with changes in fixed cost, then that sales mix which provides the highest *profit* is considered as the most profitable sales mix. In other words, relative profitability of mixes will be evaluated on the basis of their profit and not on the basis of their contribution when a change in product mix is associated with change in fixed cost.

Illustration 6.5

The following production/sales mix are capable of achievement in a factory:

(i) 2,000 units of product A and 2,000 units of product C.
(ii) 4,000 units of product B.
(iii) 1,000 units of product A, 2,000 units of product B and 1,600 units of product C.

Cost per unit is as follows:

	A	B	C
Direct materials	₹ 20	16	40
Direct wages	₹ 8	10	20

Fixed cost is ₹ 20,000 and variable overheads per unit of A, B and C are ₹ 2, ₹ 4 and ₹ 8 respectively. Selling prices of A, B and C are ₹ 36, ₹ 40 and ₹ 100 per unit respectively.
Determine the marginal contribution per unit of A, B and C and the profits resulting from product mixes (*i*), (*ii*) and (*iii*). *(B.Com)*

Solution

Marginal Cost Statement

	Per unit of products		
	A	B	C
	₹	₹	₹
Selling price (S)	36	40	100
Direct material	20	16	40
Direct wages	8	10	20
Variable overhead	2	4	8
Variable cost (V)	30	30	68
Contribution (S – V)	6	10	32

Statement Showing Comparative Profitability

Sales	*Contribution*	*Total contribution*	*Fixed cost*	*Profit*
(*i*) A 2,000 units	12,000			
C 2,000 units	64,000	76,000	20,000	56,000
(*ii*) B 4,000 units	40,000	40,000	20,000	20,000
(*iii*) A 1,000 units	6,000			
B 2,000 units	20,000			
C 1,600 units	51,200	77,200	20,000	**57,200**

Conclusion. The sales mix (iii) is the most profitable as it yields the highest amount of contribution and profit.

(*b*) When there is a key factor

When a key factor is operating, selection of the most profitable sales mix is based on contribution per unit of key factor. The product which makes the highest amount of contribution per unit of key factor, is the most profitable one and its production is pushed up. The second preference is to be given to product which yields the second highest contribution per unit of key factor and so on and in the end that product should be produced which yields least contribution per unit of key factor and to the extent of availability of the key factor.

In case a number of key factors are operating simultaneously, the basic principle remains the same but problem becomes more mathematical in nature and one has to resort to Linear Programming to determine the optimal product mix.

Illustration 6.6

A company manufactures three products. The budgeted quantity, selling prices and unit costs are as under :

	A	B	C
	₹	₹	₹
Raw materials (@ ₹ 20 per kg)	80	40	20
Direct wages (@ ₹ 5 per hour)	5	15	10

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Variable overheads	10	30	20
Fixed overheads	9	22	18
Budgeted production (in units)	6,400	3,200	2,400
Selling price per unit (in ₹)	140	120	90

Required :

(*i*) Present a statement of budgeted profit.

(*ii*) Set optimal product-mix and determine the profit, if the supply of raw materials is restricted to 18,400 kg. *(B.Com. Hons. Delhi)*

Solution

(*i*) Statement of Budgeted Profit

	A	*B*	*C*	*Total* ₹
Budgeted production (units)	6,400	3,200	2,400	
Selling price ₹	140	120	90	
Sales (S)	8,96,000	3,84,000	2,16,000	14,96,000
Raw materials	5,12,000	1,28,000	48,000	
Direct wages	32,000	48,000	24,000	
Variable overhead	64,000	96,000	48,000	
Total variable cost (V)	6,08,000	2,72,000	1,20,000	10,00,000
Contribution (S–V)	2,88,000	1,12,000	96,000	4,96,000
Less: fixed cost*				1,71,200
Profit				3,24,800

***Calculation of Fixed Cost**

A = 6,400 unit × ₹ 9	=	₹ 57,600
B = 3,200 units × ₹ 22		70,400
C = 2,400 units × ₹ 18		43,200
Total fixed cost	=	₹ 1,71,200

(*ii*) When raw material is the key factor

	A	*B*	*C*
Raw material per unit of output	4 kg	2 kg	1 kg
Total raw material consumed (kg)	6400 × 4	3200 × 2	2400 × 1
	= 25,600	= 6,400	= 2,400
*Contribution per kg of raw material	= ₹ 2,88,000 / 25,600 kg.	= ₹ 1,12,000 / 6,400 kg.	= ₹ 96,000 / 2,400 kg.
	= ₹ 11.25	= ₹ 17.50	= ₹ 40
Ranks	**III**	**II**	**I**

*Contribution per kg of raw material is calculated as :

Total contribution ÷ Total raw materials consumed

Suggested sales mix (raw material is the key factor)

Rank I – Product *C* – 2,400 units × 1 kg	= 2,400 kg	
Rank II – Product *B* – 3,200 units × 2 kg		= 6,400 kg
Rank III – Product *A* – 2,400 units × 4 kg (balance)	= 9,600 kg	
Total materials available	18,400 kg	

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Thus the suggested product mix is : *A* – 2,400 units, *B* 3,200 units and *C* – 2,400 units

Calculation of Profit		Contribution
Product *A*	2,400 units @ ₹ 45 p.u.	₹ 1,08,000
B	3,200 units @ ₹ 35 p.u.	₹ 1,12,000
C	2,400 units @ ₹ 40 p.u.	₹ 96,000
Total contribution		3,16,000
Less: Total fixed cost		1,71,200
	Profit	₹ 1,44,800

5. Plant Shut Down Decisions

The management under certain circumstances might feel that plant shut down, *i.e.*, closing down the business, is better than operating at a loss. However, variable costing analysis may prove that this is not always so. This type of situation usually arises when sufficient sales cannot be achieved.

This type of decision may be either (*a*) temporary suspension of production activities, or (*b*) permanent closing down of production.

Temporary Closing Down. Temporary suspension of activities is a short-term measure. The object is usually to stop operations until trade depression has passed. The question before management is: when should operations be suspended? or in other words, how long should operations be continued? The answer to this question is that if products are making a contribution towards fixed cost, then generally speaking, production should not be suspended. This is so because continuing production will help minimising loss which would be incurred if plant is shut down. Thus, the information needed to solve this type of problem involves a comparison between probable loss at a given level of output and the loss that would be suffered if production is suspended temporarily.

Example: A manufacturing company supplies you the following information:

Normal capacity of plant	10,000 units
Fixed cost	₹ 1,00,000
Marginal cost per unit	₹ 75
Estimated selling price	₹ 80
Estimated sales volume at this selling price	5,000 units

Marginal Cost Statement

	Total sales (5,000 units × ₹ 80)	4,00,000
Less:	Marginal cost (5,000 units × ₹ 75)	3,75,000
	Contribution	25,000
	Fixed cost	1,00,000
	Loss	(–) 75,000

If plant is shut down, the loss due to fixed cost would be ₹ 1,00,000. However, if plant is operated, the loss would only be ₹ 75,000. This is because selling price is above the marginal cost and is making a contribution towards fixed cost.

Role of Committed and Discretionary Fixed Costs. Sometimes, certain fixed costs can be avoided by management when plant is not operative. These are termed as discretionary fixed costs. Committed fixed costs, on the other hand, are those that cannot be avoided even if production is discontinued.

In decisions to close down temporarily, contribution should be compared with fixed cost which is to be incurred when plant is shut down, *i.e.*, committed fixed cost.

Examples of fixed costs which may be avoided by closing down are: advertisement cost, research and development, part of salaries, etc. Longer the period of shut down, the larger the amount of avoidable fixed cost is likely to be.

Example:

Normal capacity of plant		10,000 units
Fixed cost when plant is operating	₹	1,00,000
Fixed cost when plant is shut down	₹	80,000
Variable cost per unit	₹	75
Selling price per unit	₹	80

Estimated sales volume at this price – 5,000 units.

Marginal Cost Statement

	Sales (5,000 units @ ₹ 80)	4,00,000
Less:	*Marginal* cost (5,000 units @ ₹ 75)	3,75,000
	Contribution	25,000
	Fixed cost if plant is operating	1,00,000
	Loss	(–) 75,000

Now if the plant is shut down, the loss due to fixed cost would be ₹ 80,000 whereas, if plant is operated, the loss would be ₹ 75,000. The effect of plant operating is only a small amount of loss of ₹ 5,000 (*i.e.*, 80,000 – 75,000). Thus keeping in view this small amount, operating a plant offers certain non-cost advantages like keeping the plant in gear, retaining the customers, retaining all the skilled labour and managerial personnel. Thus, it would be advisable to continue the production even if there is a small amount of loss because the non-cost factors outweigh the loss.

In case the selling price is below the marginal cost and makes no contribution towards fixed cost, then on cost considerations, the plant should be temporarily shut down. But a final decision in the regard should be taken after considering non-cost factors like effect of shut down on plant, fear of losing the market, effect on relationship with workers and suppliers, etc.

Permanent Shut Down. So far as permanent closing down of business is concerned, such a decision is a drastic step and should be taken only when in the long run, the business does not expect to earn a sufficient return to cover the risk involved. In other words, in the long-run, selling price must not only cover the total cost but should also give a reasonable return on the capital employed.

DIFFERENTIAL COST ANALYSIS

It has been stated earlier that in decision-making, the management has to compare two or more alternatives. Differential cost analysis is a special technique to help management in decision-making which shows how costs and revenues would be different under different alternative courses of action.

Meaning of Differential Cost

Differential cost is the difference in cost between one alternative and another. It is obtained by subtracting the cost of one alternative from the cost of the other alternative. For example, when management is considering a change in the level of production, differential cost will be calculated by substracting the cost at lower level of production from that of a higher level.

Example:

	Alternative I	Alternative II	Differential cost/revenue
Output (units)	5,000	7,500	2,500
	₹	₹	₹
Materials	20,000	30,000	10,000
Labour	6,000	9,000	3,000
Variable overhead	4,000	6,000	2,000
Fixed overhead	5,000	6,000	1,000
Total cost	35,000	51,000	16,000
Sales	50,000	70,000	20,000

Thus, in order to produce additional 2,500 units, additional cost is ₹ 16,000 (*i.e.*, 51,000 – 35,000). In other words, differential cost for 2,500 units is ₹ 16,000. It should be noted in this example, that if additional output does not involve any additional fixed cost to be incurred, the differential cost will be equal to marginal or variable cost. Thus, when fixed costs remain constant, the differential cost is synonymous with the variable costs of producing the n-units. It is for this reason that differential cost is sometimes referred to as marginal cost.

Sometimes the term *incremental* cost is also interchangeably used with differential cost. The readers should note that incremental cost actually means only an increase in cost from one alternative to another. In the above example, it costs ₹ 51,000 to produce 7,500 units and ₹ 35,000 to produce 5,000 units, the incremental (and differential) cost of producing additional 2,500 units is ₹ 16,000. In the same way, differential cost may be referred to a *decremental cost*, where decrease in output is being considered.

Incremental Revenue. Difference in revenue of two alternatives is termed as incremental revenues. In differential cost analysis, decisions are taken on the basis of comparison of differential cost with incremental n(or decremental) revenue. An alternative is considered profitable when incremental revenue is more than differential cost. In the above example, differential cost is ₹ 16,000 whereas incremental revenue is ₹ 20,000. This means alternative II produces additional profit of ₹ 4,000 (*i.e.*, 20,000 – 16,000) and is thus, acceptable.

Differential Cost Analysis Vs. Variable Costing

As stated earlier, differential cost may be synoymous with variable cost. In fact, the theory of variable costing is only a part of the more comprehensive technique of differential costing. These two techniques are similar in some respects but alsodiffer in certain other fields. The points of similarity and difference are summarised below :

Similarities

1. Both the techniques are based on the classification of costs into fixed and variable. When fixed costs do not change, the differential cost and variable cost are the same.
2. Both differential costing and variable costing are techniques of cost analysis and presentation.
3. Both the techniques are used by the management in decision-making and formulating policies.

Differences

1. The technique of variable costing excludes all fixed costs from its analysis, whereas, differential cost analysis includes identifiable or traceable fixed costs. (Identifiable fixed costs are those which change between alternatives since these are identifiable with specific alternatives).
2. Variable costs may be incorporated into the formal accounting system while differential costs are worked out separately for reporting to management for making specific decisions.
3. In variable costing, contribution, P/V ratio, key factors, etc., are the main yardsticks for evaluation of performance and making-decisions. In differential cost analysis, on the other hand, comparison is made between differential cost and incremental revenue for decision-making purposes.
4. Differential cost analysis can be made in the case of both absorption costing as well as variable costing.

DECISION MAKING AND DIFFERENTIAL COST ANALYSIS

Many managerial decisions involving problems of alternative choices are made with the help of differential cost analysis. Such decisions include the following:

1. Determination of the Optimum Level of Production

The optimum level is that level of production where profit is the maximum. In order to arrive at a decision of this type, the differential costs are compared with incremental revenue at various levels of output. So long as the incremental revenue exceeds differential costs, it is profitable to increase the output. But as soon as the differential cost equals or exceeds incremental revenue, it is no more profitable to increase the volume of output.

Illustration 6.7

A company has a capacity of producing 1,00,000 units of a certain product in a month. The sales department reports that the following schedule of sale prices is possible:

Volume of production			*Selling price per unit* ₹
At 60% capacity	60,000 units		0.90
At 70% capacity	70,000 units		0.80
At 80% capacity	80,000 units		0.75
At 90% capacity	90,000 units		0.67
At 100% capacity	1,00,000 units		0.61

Variable cost of manufacture is 15 paise per unit and total fixed cost ₹ 40,000.

Prepare a statement showing incremental revenue and differential cost of each stage. At which volume of production will the profit be maximum ?

Solution

Statement of Differential Cost and Incremental Revenue

Capacity	Units of output	Variable cost @ ₹ 0.15 ₹	Fixed cost ₹	Total cost ₹	Differential cost ₹	Sales ₹	Incremental revenue ₹
60%	60,000	9,000	40,000	49,000	—	54,000	—
70%	70,000	10,500	40,000	50,500	1,500	56,000	2,000
80%	80,000	12,000	40,000	52,000	1,500	60,000	4,000
90%	90,000	13,500	40,000	53,500	1,500	60,300	300
100%	1,00,000	15,000	40,000	55,000	1,500	61,000	700

At 80% volume of production, profit is maximum. This is because at this level, incremental revenue is ₹ 4,000 whereas, differential cost is ₹ 1,500, resulting in additional profit of ₹ 2,500 (*i.e.*, ₹ 4,000 – 1,500). After 80% level, differential cost exceeds incremental revenue thereby resulting in a loss.

2. Acceptance of a Special Order

Sometimes management has to take a decision to accept or refuse an additional order for one of its products at a price which is below the customary sale price. Such an order can prove attractive when a business is working below full production capacity and the price offered results in incremental revenue which is more than differential costs.

Illustration 6.8

Continuing Illustration 6.7, if there is a bulk offer for export at 50 paise per unit for the balance capacity over the maximum profit volume and the price quoted will not affect the internal sales, will you advise accepting this bid and why?

Solution

	Internal Market (80,000 units)	*Special Order for export (20,000 units)*	*Total (1,00,000 units)*
	₹	₹	₹
Variable cost @ 15 paise per unit	12,000	3,000	15,000
Fixed cost	40,000	—	40,000
Total cost	52,000	3,000	55,000
Sales	60,000	10,000	70,000
Profit	8,000	7,000	15,000

It is advisable to accept the bulk offer @ ₹ 0.50 per unit for the balance capacity of 20,000 units (i.e., 1,00,000 – 80,000) for export as it will result in an increase of profit by ₹ 7,000.

3. Adding or Dropping a Product Line

In a multi-product company, the management may have to decide on adding or dropping a product line. When a new product line is added, its sales and certain costs will also be increased and reverse will happen when a product line is dropped. In order to arrive at such a decision, the management should

compare the differential cost and incremental revenue and study its effect on the overall profit position of the company.

4. Evaluating Make or Buy Alternatives

Make or buy decisions based on variable costing have already been discussed in this chapter. However, when making of a component requires addition investment in plant, it results in additional fixed cost to be incurred. In such a situation make or buy decision is based on comparison of differential cost and incremental revenue and its effect on profit.

5. Decision regarding Further Processing of Joint/By-products

Sometimes management has to take a decision regarding further processing of joint or by-products after split off point. For example, a milk dairy may sell cream as such or further process it into butter or ghee. In such a case apportionment of joint cost upto split off point is not relevant for the purpose of decision-making regarding further processing of joint products or by-products. Such decisions are taken an the basis of comparison of differential cost and incremental revenue. It is profitable to further process a product if incremental revenue is more than differential cost on further processing.

Illustration 6.9

In a company engaged in process industry, four products emerge from a particular process of operation. The total cost of input for the period ended 30th September 2017 is ₹ 2,53,000. The details of output, additional cost after "split-off-point" and sales value of the products are appended below:

Products	*Output Kgs.*	*Share in joint cost* ₹	*Additional process cost after split-off point* ₹	*Sales value* ₹
A	8,000	85,000	60,000	1,68,000
B	5,000	67,000	10,000	1,10,000
C	3,000	41,000	2,000	60,000
D	4,000	60,000	18,000	90,000

If the products are sold at "split-off point" without further processing, the sales value would have been :

A	₹	1,15,000
B	₹	90,000
C	₹	55,000
D	₹	80,000

You are required to prepare a statement of profitability and advise whether products should be sold at split off point or should be further processed.

Solution

Products	*Output Kg.*	*Cost allotted* ₹	*Sales at Split off point* ₹	*Profit at split off point* ₹	*Incremental cost* ₹	*Sales value* ₹	*Incremental revenue* ₹
A	8000	85,000	1,15,000	30,000	60,000	1,68,000	53,000
B	5000	67,000	90,000	23,000	10,000	1,10,000	20,000
C	3000	41,000	55,000	14,000	2,000	60,000	5,000
D	4000	60,000	80,000	20,000	18,000	90,000	10,000

Notes: 1. Profit at split off point is the difference between sales at split off point and cost allotted.
2. Incremental cost is additional processing cost after split off point.
3. Incremental revenue is the difference between sales at split off point and sales after further processing.

Conclusion. A product should be further processed if incremental revenue is more than incremental or differential cost. In this case, product B and C should be further processed because their incremental revenue is more than incremental cost. Product A and D should be sold at split off point and should not be processed further because their incremental cost is more than incremental revenue.

PROBLEMS AND SOLUTIONS

Problem 6.1 (*Selling Price for Bulk Order*)

(*a*) An umbrella manufacturer makes an average profit of ₹ 2.50 per unit on a selling price of ₹ 14.30 by producing and selling 60,000 units at 60 per cent of potential capacity.

His cost of sales per unit is as follows :

Direct materials	₹ 3.50
Direct wages	₹ 1.25
Factory overhead	₹ 6.25 (50% fixed)
Sales overhead	₹ 0.80 (25% variable)

During the coming year 2017-18, he intends to produce the same number but estimates that his fixed cost would go up by 10 per cent while the rates of direct wages and direct materials will increase by 8% and 6% respectively. However, the selling price cannot be changed.

Under this situation, he obtains an offer for a further 20% of his potential capacity.

What minimum price would you recommend for acceptance of the offer to ensure the manufacturer and overall profit of ₹ 1,67,300?

(*B.Com. Hons. Delhi*)

(*b*) (I) Prepare a Statement of Marginal Cost and Profit for the year 2011-12.

(II) Answer the following, explaining the relevant cost and non-cost factors in the following independent situations, assuming that existing domestic sales will continue :

(*i*) The company obtains an export order for a further 30% of the potential capacity at a price of ₹ 9 per unit. Should this order be accepted ?

(*ii*) What will be your answer if export order is at ₹ 8.25 per unit (instead of ₹ 9 per unit) for a further 30% of the potential capacity ?

(*iii*) What will be your answer if instead of export order, the offer is from a domestic market for a bulk supply of 30,000 units at ₹ 10 per unit ?

(*B.Com Hons. Delhi*)

Solution

(a) Statement of Marginal Cost and Profit
for the year 2011-12

	Per unit ₹	60,000 units ₹
Sales	14.300	8,58,000
Direct materials (3.50 + 6%)	3.710	2,22,600
Direct wages (1.25 + 8%)	1.350	81,000
Variable overhead – Factory	3.125	1,87,500
– Sales	0.200	12,000
Variable cost	8.385	5,03,100
Contribution (Sales – Variable cost)		3,54,900
*Fixed cost		2,45,850
Profit		1,09,050

***Calculation of fixed overhead**

Factory overhead —	60,000 units @ ₹ 3.125 = ₹	1,87,500
Sales overhead —	60,000 units @ Re 0.60 = ₹	36,000
		2,23,500
Add: 10% increase		22,350
Fixed cost	₹	2,45,850

Statement of Price Recommendation *(For 20,000 units)*

	₹
Marginal cost (₹ 8.385 × 20,000 units)	1,67,700
Additional profit required (1,67,300 – 1,09,050)	58,250
Total sales value	2,25,950

Selling price per unit (2,25,950 ÷ 20,000) = **₹ 11.30** (Approx.)

(*b*) (*i*) The export order should be accepted because the export price of ₹ 9 is more than variable cost of ₹ 8.385 per unit. The acceptance of this export order will make an additional contribution (or profit) of ₹ 18,450 (*i.e.*, ₹ 9 – ₹ 8.385) × 30,000 units).

(*ii*) The export order at ₹ 8.25 will result in a loss because it is less than the variable cost. Since the amount of loss is not significant, the export order should not be outrightly rejected but management should consider accepting this order for non-cost considerations, such as earning of foreign exchange, enhancement in the goodwill of the company because of export house status, etc.

(*iii*) The order at ₹ 10 per unit from domestic market is definitely above variable cost and will result in a profit. But since this is a case of sale in the domestic market, the company has to ensure that price discrimination is possible *i.e.*, the buyer should sell in a different domestic market and not compete with the company's sales, otherwise company's sales will be adversely affected. Thus such an order should be accepted only subject to certain conditions such as re-sales price maintenance, price discrimination, etc.

Problem 6.2 (Export Order)

Smart Exports Ltd. is producing and selling 20,000 units of its product in the home market at a price of ₹ 60 per unit. The per unit cost is as follows :

Direct materials	₹ 10 per unit
Direct labour	₹ 7 per unit
Factory expenses :	
Fixed	₹ 12 per unit
Variable	₹ 4 per unit
Office and selling expenses :	
Fixed	₹ 6 per unit
Variable	₹ 3 per unit

An importer from Australia placed an order for 6,000 units at a price of ₹ 30 per unit. Execution of Australian order will result in an additional total cost of ₹ 10,000 over and above the variable cost. Should the Australian order be accepted ? Show complete working.

(B. Com. Hons. Delhi)

Solution

Marginal Cost Statement

		Total ₹ (20,000 units)	*Per unit ₹*
	Sales	12,00,000	60
Less:	Variable costs :		
	Direct materials	2,00,000	10
	Direct labour	1,40,000	7
	Variable overhead — Factory	80,000	4
	— Office and selling	60,000	3
	Total variable Cost	4,80,000	24
	Contribution (Sales – variable cost)	7,20,000	36
	Fixed cost — Factory	2,40,000	12
	— Office and selling	1,20,000	6
	Total fixed cost	3,60,000	18
	Profit (Contribution — Fixed cost)	3,60,000	18

Profitability Statement (Export Order)

	₹
Export sales (6,000 units @ ₹ 30)	1,80,000
Less : Varaible cost (@ ₹ 24 for 6,000 units)	1,44,000
	36,000
Less : Additional cost of exports	10,000
Profit	**26,000**

Conclusion. Acceptance of export order from Australia would result in an additional profit of ₹ 26,000. Therefore, the export order should be accepted.

Problem 6.3 (*Export Order*)

A manufacturer has planned his level of operation at 50% of his plant capacity of 30,000 units. His expenses are estimated as follows, if 50% of the plant capacity is utilised:

	₹
(*i*) Direct materials	8,280
(*ii*) Direct wages	11,160
(*iii*) Variable and other manufacturing expenses	3,960
(*iv*) Total fixed expenses irrespective of capacity utilisation	6,000

The expected selling price in the domestic market is ₹ 2 per unit. Recently the manufacturer has received a trade enquiry from an overseas organisation interested in purchasing 6,000 units at a price of ₹ 1.45 per unit.

As a professional management accountant, what would be your suggestion regarding acceptance or rejection of the offer ? Support your suggestion with suitable quantitative information. (*I.C.W.A. Inter*)

Solution

Profitability Statement

	15,000 units (For domestic sale)		*6,000 units (For export)*		*Total 21,000 units*
	Total ₹	*Per unit* ₹	*Total* ₹	*Per unit* ₹	*Total* ₹
Sales	30,000	2.000	8,700	1.450	38,700
Direct Materials	8,280	0.552	3,312	0.552	11,592
Direct wages	11,160	0.744	4,464	0.744	15,624
Variable expenses	3,960	0.264	1,584	0.264	5,544
Total variable cost	23,400	1.560	9,360	1.560	32,760
Contribution	6,600	0.440	(–)660	(–)0.110	5,940
Less: Fixed cost	6,000	—	—	—	6,000
Profit/Loss (–)	600	—	(–)660	—	(–)60

Conclusion. The offer for export at ₹ 1.45 per unit is less than the variable cost of ₹ 1.56 per unit. There is a negative contribution of ₹ 0.11 per unit resulting in a loss of ₹ 660 on 6,000 additional units. It is thus not profitable to accept this foreign offer. However, before taking a final decision, certain non-cost factors like enlarging market for company's products, earning foreign exchange, etc. may also be considered.

Problem 6.4 (*Export Order*)

A company currently operating at 80% capacity has the following particulars:

	₹
Sales	32,00,000
Direct materials	10,00,000
Direct labour	4,00,000
Variable overheads	2,00,000
Fixed overheads	13,00,000

An export order has been received that would utilise half the capacity of the factory. The order cannot be split, *i.e.*, it has either to be taken in full and executed at 10% below the normal domestic prices or rejected totally.

The alternatives available to the management are :

(1) Reject the order and continue with the domestic sales only (as at present), or

(2) Accept the order, split capacity between overseas and domestic sales and turn away excess domestic demand, or

(3) Increase capacity to accept the export order and maintain the present domestic sales by :

(*a*) buying an equipment that will increase capacity by 10%. This will result in an increase of ₹ 1,00,000 in fixed costs, and

(*b*) work overtime to meet balance of required capacity. In that case, labour will be paid at one and a half times the normal wage rate.

Prepare a comparative statement of profitability and suggest the best alternative. *(C.A. Inter)*

Solution

Profitability Statement

	Alternatives		
	I *Present position 80% domestic sales only*	*II* *50% capacity for domestic sales and 50% capacity for export*	*III* *80% capacity for domestic sales and 50% capacity for export*
	₹	₹	₹
Sales (domestic)	32,00,000	20,00,000	32,00,000
Sales (export)	—	18,00,000	18,00,000
Total Sales (A)	32,00,000	38,00,000	50,00,000
Direct materials	10,00,000	12,50,000	16,25,000
Direct labour	4,00,000	5,00,000	7,00,000
Variable overhead	2,00,000	2,50,000	3,25,000
Total Variable Cost (B)	16,00,000	20,00,000	26,50,000
Contribution (A–B)	16,00,000	18,00,000	23,50,000
Less: Fixed overheads	13,00,000	13,00,000	14,00,000
Profit	3,00,000	5,00,000	9,50,000

Conclusion. Alternative III is the best because it results in the highest amount of profit.

Working Notes:

1. Sales at 80% capacity = ₹ 32,00,000

   at 100% $= 32,00,000 \times \frac{100}{80} =$ ₹ 40,00,000

2. Sales (export) at 50% capacity = 20,00,000 – 10% = ₹ 18,00,000

3. Direct material cost for alternative II (100% capacity)

   $10,00,000 \times \frac{100}{80} =$ ₹ 12,50,000

4. Direct material cost for alternative III (130% capacity)

   $10,00,000 \times \frac{130}{80} =$ ₹ 16,25,000

Similar calculations are made for labour cost and variable overhead at 100% and 130% capacities. Labour cost at 130% is calculated on the assumption that overtime will be required only for 20% capacity because additional plant will raise capacity by 10% which will not require overtime working.

Thus, labour cost for alternative II.

$$\text{At } 100\% = 4,00,000 \times \frac{100}{80} = ₹\ 5,00,000.$$

Labour cost for alternative III

$$\text{At } 130\% = \left(4,00,000 \times \frac{110}{80}\right) + \left(4,00,000 \times \frac{20}{80} \times \frac{3}{2}\right)$$

$$= 5,50,000 + 1,50,000 = ₹\ 7,00,000.$$

Problem 6.5 (*Export Order*)

Pieco Engineering Company has received an once-off export order for its sole product that would require the use of half of the factory's total capacity, which is estimated at 4 lakh units per annum. The condition of the export order is that it has to be accepted in full, acceptance of part quantity is not allowed.

The factory is currently operating at 60% level to meet the demand of its domestic customers. As against the current price of ₹ 6.00 per unit, the export offer is ₹ 4.70 per unit, which is less than the total cost of current production.

The cost break-down is given below:

Direct material	₹ 2.50 per unit
Direct labour	₹ 1.00 per unit
Variable expense	₹ 0.50 per unit
Fixed overhead	₹ 1.00 per unit
Total cost	₹ 5.00 per unit

The company has the following options:

(*a*) Accept the export order and cut back domestic sales as necessary.

(*b*) Remove the capacity constraint by installing necessary balancing equipment and also by working overtime to meet both domestic and export demand. This will increase fixed overheads by ₹ 15,000 annually and additional cost for overtime work will amount to ₹ 40,000 for the year.

(*c*) Appoint a sub-contractor to manufacture the additional requirement and meet the domestic and export requirement in full by supplying raw materials, paying a conversion charge @ ₹ 2.00 per unit and appointing a supervisor at a salary of ₹ 3,000 per month for checking the quality of the product and controlling operations at manufacturing unit.

(*d*) Refuse the order

Required:

(*i*) A statement of costs and profit under each of the above four options.

(*ii*) Your recommendation, with reasons, as to which of these options the company should decide upon.

(I.C.W.A. Inter)

Solution.

Profitability Statement

Alternatives	I	II	III	IV
Sales (units) — Domestic	2,00,000	2,40,000	2,40,000	2,40,000
— Exports	2,00,000	2,00,000	2,00,000	—
	4,00,000	4,40,000	4,40,000	2,40,000
Total Sales (₹) — Domestic	12,00,000	14,40,000	14,40,000	14,40,000
— Exports	9,40,000	9,40,000	9,40,000	
(A) Total sales (₹)	21,40,000	23,80,000	23,80,000	14,40,000
(B) Variable cost ₹	16,00,000	18,00,000	17,80,000	9,60,000
(C) Contribution (A–B)	5,40,000	5,80,000	6,00,000	4,80,000
(D) Fixed cost	2,40,000	2,55,000	2,76,000	2,40,000
Profit (C–D)	3,00,000	3,25,000	3,24,000	2,40,000

Conclusion. Though alternative II showing a profit of ₹ 3,25,000 appears the most profitable, it requires large capital investment. If export orders are not repeated in future, it will result in under utilisation of capacity. Overtime may also create problems in future.

Compared to alternative II, alternative III offers a profit of ₹ 3,24,000 which is short by only ₹ 1,000. But it does not create problems of capital investment and overtime. Thus, alternative III appears most acceptable.

Working Notes:

Variable cost per unit — Material ₹ 2.50
Labour 1.00
Variable expenses 0.50
Total 4.00

Variable cost — Alternative II
4,40,000 units × ₹ 4 ₹ 17,60,000
Add: Overtime payment 40,000
Total 18,00,000

Variable cost — Alternative III
4,00,000 units × ₹ 4 ₹ 16,00,000
Raw material 40,000 units @ ₹ 2.50 1,00,000
Add: Overtime payment 80,000
Total 17,80,000

Fixed cost — Alternative II 2,40,000 + 15,000 = ₹ 2,55,000
Alternative III 2,40,000 + 36,000 = ₹ 2,76,000

Problem 6.6 (*Export order*)

R.B. & Company is presently operating at 50% of practical capacity producing about 50,000 units annually of a patented electronic component. *R.B.* recently received an offer from overseas market to sell 30,000 components at ₹ 6.00 per unit, FOB *R.B.*'s plant. R.B. has not previously sold components in this market. Budgeted production cost for 50,000 and 80,000 units of output is as follows:

	50,000 units	80,000 units
	₹	₹
Direct material	75,000	1,20,000
Direct labour	75,000	1,20,000
Factory overhead	2,00,000	2,60,000
	3,50,000	5,00,000
Cost per unit	7.00	6.25

The sales manager thinks the order should be accepted, even if it results in a loss of ₹ 1.00 per unit, because he feels the sales may build up future market. The production manager does not wish to have the order accepted primarily because the order would show a loss of ₹ 0.25 per unit when computed on the new average unit cost. The cost accountant has made a quick computation indicating that accepting the order will actually increase profit.

You are required to:

(*a*) Explain what apparently caused the drop in cost from ₹ 7.00 per unit to ₹ 6.25 per unit when budgeted production increased from 50,000 to 80,000 units. Show supporting computations.

(*b*) Should the order be accepted? *(I.C.W.A. Inter)*

Solution

Statement of Cost

	50,000 units		80,000 units	
	Total	*Per unit*	*Total*	*Per unit*
	₹	₹	₹	₹
Direct material	75,000	1.50	1,20,000	1.50
Direct labour	75,000	1.50	1,20,000	1.50
Factory overhead : Variable	1,00,000	2.00	1,60,000	2.00
Fixed	1,00,000	2.00	1,00,000	1.25
Total	3,50,000	7.00	5,00,000	6.25

Calculation of fixed overhead

Difference in factory overhead between two level = 2,60,000 – 2,00,000 = ₹ 60,000

Thus, variable overhead for 30,000 (additional) units = ₹ 60,000

Variable overhead per unit = 60,000 ÷ 30,000 = ₹ 2

Variable overhead for 50,000 units = 50,000 × ₹ 2 = ₹ 1,00,000

Fixed cost = 2,00,000 – 1,00,000 = ₹ 1,00,000

Comments (*a*) The drop in cost per unit from ₹ 7 to ₹ 6.25 is because of decrease in fixed cost per unit. This is so because at 50,000 units fixed cost is ₹ 2 per unit while at 80,000 units this comes down to ₹ 1.25. This decrease in fixed cost by 75 paise has resulted in drop in total cost by 75 paise, *i.e.*, from ₹ 7 to ₹ 6.25. It is important to note that fixed cost per unit comes down when output is increased.

(*b*) The order from overseas, market should be accepted as it makes a contribution to profit. This is shown below:

		₹	₹
	Incremental revenue (₹ 30,000 × ₹ 6)		1,80,000
Less:	Incremental cost :		
	Direct material	45,000	
	Direct labour	45,000	
	Variable overhead @ ₹ 2 per unit	60,000	1,50,000
	Contribution (or Profit)		30,000

Thus, acceptance of this offer will result in additional profit of ₹ 30,000.

Problem 6.7 (Acceptance of a Special Order)

PQR Ltd. manufactures medals for winners of athletic events and other contests. Its manufacturing plant has the capacity to produce 10,000 medals each month. The company has current production and sales level of 7,500 medals per months. The current domestic market price of the medal is ₹ 150. The cost data for the month of October is as under:

Variable costs (that vary with units produced)

	₹
Direct materials	2,62,500
Direct manufacturing labour	3,00,000
Variable costs (that vary with number of batches)	
Set-ups, materials handling, quality control	
150 batches × ₹ 500 per batch	75,000
Fixed manufacturing costs	2,75,000
Fixed marketing costs	1,75,000
₹	10,87,500

PQR Ltd. has received a special one-time-order for 2,500 medals at ₹ 100 per medal.

PQR Ltd. makes medals for its existing customers in batch size of 50 medals.
(150 batches × 50 medals per batch = 7,500 medals)

The special order for 2,500 medals requires *PQR* Ltd. to manufacture the medals in 25 batches of 100 each.

Required:

(*i*) Should *PQR* Ltd. accept the special order? Why? Explain briefly.

(*ii*) Suppose the plant capacity was 9,000 medals instead of 10,000 medals each month. The special order must be taken either in full or rejected totally. Should *PQR* Ltd. accept the special order? Why? Explain briefly.

(C.A. Inter)

Solution

(i) **Profitability Statement**

			₹
Sales (2,500 medals @ ₹ 100)			2,50,000
Less: Variable Costs:			
Materials	(2,500 medals @ ₹ 35)	87,500	
Labour	(2,500 medals @ 40)	1,00,000	
Set ups	(25 batches @ ₹ 500)	12,500	2,00,000
Contribution			50,000

Conclusion. The special order should be accepted because it gives a contribution of ₹ 50,000.

(ii) When plant capacity is 9,000 medals.

			₹
Present contribution on 7500 medals :			
Sales (7500 × 150)			11,25,000
Less Variable costs :			
Materials (7,500 × 35)		2,62,500	
Labour (7,500 × 40)		3,00,000	
Set up (150 batches × ₹ 500)		75,000	6,37,500
	Contribution		4,87,500

Contribution on 6,500 medals

			₹
Sales	(6,500 × 150)		9,75,000
Less: Variable costs		2,27,500	
Materials	(6,500 × 35)	2,60,000	
Labour	(6,500 × 40)	65,000	5,52,500
Set-ups	(130 × 500)		
	Contribution		4,22,500

Acceptance of special order when capacity is 9,000 medals

	₹
Gain in contribution on acceptance of special order	50,000
Loss in contribution (4,87,500 – 4,22,500)	65,000
Net Loss in contribution	15,000

Conclusion. When plant capacity is 9,000 medals, the special order should not be accepted because it results in loss of contribution of ₹ 15,000.

Problem 6.8 (*Special Order*)

A machine shop in a factory is working to its full capacity and earning a contribution of ₹ 50 per hour. The management receives a high priority order which it wants to execute immediately. Material will be supplied by the customer and the special order will take a minimum of 10 hours. Wages payable will be ₹ 15 per hour and variable overhead will be 150% of wages. If the customer is prepared to pay ₹ 800 for the order, should the order be accepted. (*I.C.W.A. Inter*)

Solution

Calculation of the cost of special order

		₹
Direct wages (10 hrs × ₹ 15)		150
Variable overhead (150% of ₹ 150)		225
Loss of contribution (10 hrs × ₹ 50)		500
	Cost of special order	875
	Price offered by customer	800
	Loss	75

Decision. The order should not be accepted as it would give a loss of ₹ 75.

Problem 6.9 (*Export Order*)

A company selling electric kits at a cost of ₹ 6,900 each, made up as under:

	₹
Direct materials	3,200
Direct labour	400
Variable overhead	1,000
Fixed overhead	200
Depreciation	200
Selling overhead–variable	100
Royalty	200

Profit	1,000
Central excise duty	6,300
	600
	6,900

(a) A foreign buyer has offered to buy 200 such kits at ₹ 5,000 each. As a Cost Accountant, would you advise accepting this offer.

(b) What price should the company quote for a kit to be purchased by a company under the same management if it should be at cost.

(C.S. Inter)

Solution

(a) Variable cost per kit is computed as follows :

	₹
Direct material	3,200
Direct labour	400
Variable overhead	1,000
Royalty (assumed to be on production)	200
Variable cost	4,800
Offer price from foreign buyer	5,000
Contribution per kit	200

Offer should be accepted as it results incremental profit of ₹ 200 per kit and a total profit of ₹ 40,000 (*i.e.*, 200 kits × ₹ 200). It is assumed (*a*) there is spare capacity, and (*b*) selling overhead are not relevant for export order.

(*b*) For the company under the same management, price to be quoted is computed as under:

		₹
Price (excluding excise duty)		6,300
Less: Profit	1,000	
Variable selling overhead	100	1,100
Price to be quoted		5,200

Note: Excise duty has not been included. It may be added, wherever payable.

Problem 6.10 (*Selling Price Decision*)

Prestige Company Private Limited, manufacturing pressure cookers has drawn up the following budget for the year 2005-06.

Ram materials	20,00,000
Labour, stores, power and other variable costs	6,00,000
Manufacturing overheads	7,00,000
Variable distribution costs	4,00,000
General overheads including selling	3,00,000
Total	40,00,000
Income from sales	50,00,000
Budgeted profit	10,00,000

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The General Manager suggests to reduce selling prices by 5% and expects to achieve an additional volume of 50%. There is sufficient manufacturing capacity. More intensive manufacturing programme will involve additional costs of ₹ 50,000 for production planning. It will also be necessary to open an additional sales office at a cost of ₹ 1,00,000 per annum.

The Sales Manager, on the other hand, suggests to increase selling price by 10% which is estimated to reduce sales volume by 10%. At the same time, saving in manufacturing overheads and general overheads at ₹ 50,000 and ₹ 1,00,000 per annum respectively is expected on this reduced volume.

Which of these two proposals would your accept and why? *(I.C.W.A. Inter)*

Solution

Comparative Statement of Budgeted Profit

	Proposal I ₹	*Proposal II* ₹
Sales	71,25,000	49,50,000
Cost of Sales :		
Raw materials	30,00,000	18,00,000
Labour, stores, power and other variable costs	9,00,000	5,40,000
Manufacturing overheads	7,50,000	6,50,000
Variable distribution cost	6,00,000	3,60,000
General overheads including selling	4,00,000	2,00,000
Total	56,50,000	35,50,000
Profit (Sales – Cost of sales)	14,75,000	14,00,000

Conclusion. Proposal I gives a higher profit of ₹ 14,75,000 and thus should be accepted.

Working Notes:

Sales:	Proposal	I	₹	50,00,000	×	$\frac{95}{100} \times \frac{150}{100}$	= ₹	71,25,000
		II	₹	50,00,000	×	$\frac{110}{100} \times \frac{90}{100}$	= ₹	49,50,000
Raw material:	Proposal	I	₹	20,00,000	+	50%	= ₹	30,00,000
		II	₹	20,00,000	–	10%	= ₹	18,00,000
Labour etc.:	Proposal	I	₹	6,00,000	+	50%	= ₹	9,00,000
		II	₹	6,00,000	–	10%	= ₹	5,40,000

Problem 6.11 (*Make or Buy Decision*)

Auto Parts Ltd. has an annual production of 90,000 units for a motor component. The component cost structure is as below :

	₹
Materials	270 per unit
Labour (25% fixed)	180 per unit

Expenses :	
Variable	90 per unit
Fixed	135 per unit
Total	675 per unit

(a) The purchase manager has an offer from a supplier who is willing to supply the component at ₹ 540. Should the component be purchased and production stopped?

(b) Assume the resources now used for this component's manufacture are to be used to produce another new product for which the selling price is ₹ 485.

In the latter case, the material price will be ₹ 200 per unit. 90,000 units of this product can be produced at the same cost basis as above for labour and expenses. Discuss whether it would be advisable to divert the resources to manufacture that new product, on the footing that the component presently being produced would, instead of being produced, be purchased form the market.

(B.Com. Hons. Delhi; C.A. Inter)

Solution

	₹
Material	270
Labour (75% of ₹ 180)	135
Variable expenses	90
Total variable cost when component is produced	495
Suppliers price	540

Excess of purchase price over variable cost = 540 – 495 = ₹ 45

(a) Fixed expenses of ₹ 180 per unit are to be incurred whether the component is made or purchased. Thus company should make the component itself because if purchased from outside it will have to pay ₹ 45 per unit more and on 90,000 units @ ₹ 45 it comes to ₹ 40,50,000.

(b) Cost implications of proposal to divert available production facilities for a new product:

			₹	₹
	Selling price of per unit of new product			485
Less:	Variable costs —	Material	200	
		Labour	135	
		Expenses	90	425
		Contribution per unit		60

Loss if present component is purchased = 540 – 495 = ₹ 45.

If company diverts the resources for the production of a new product, it will benefit by ₹ 15 (*i.e.*, ₹ 60 – 45) per unit.

On 90,000 units it will save @ ₹ 15, *i.e.*, ₹ 13,50,000. Thus, it is advisable to divert the production facilities in the manufacture of the new product and the component presently being manufactured should be bought from outside. This will result in additional profit of ₹ 13,50,000.

Problem 6.12 (*Make of Buy Decision*)

XY Ltd manufactures auto parts. The following costs are incurred for processing 1,00,000 units of a component :

Direct material cost	₹ 5 lakhs
Direct labour cost	₹ 8 lakhs
Variable factory overhead	₹ 6 lakhs
Fixed factory overhead	₹ 5 lakhs

The purchase price of the component is ₹ 22. The fixed overhead would continue to be incurred even when the component is bought from outside although there would be reduction to the extent of ₹ 2,00,000.

Required:

(1) Should the part be made or bought, considering that the present facility when released following a buying decision would remain idle?

(2) In case the released capacity can be rented out to another company for ₹ 1,50,000, what would be the decision? *(C.S. Inter)*

Solution

(a) When released capacity will remain idle, variable costs to make the component

Direct material	₹ 5 lakhs
Direct labour	₹ 8 lakhs
Variable overhead	₹ 6 lakhs
Relevant cost-to-make	₹ 19 lakhs
Purchase price of the component @ ₹ 22 per cent	₹ 22 lakhs
Less: Reduction in fixed cost	₹ 2 lakhs
Relevant cost to buy	₹ 20 lakhs

The cost to make the component is less than cost to buy. Therefore it is advisable to make the component.

(b) When released capacity is rented out

In such a situation, the cost to make will remain at ₹ 19 lakhs. But cost to buy will further reduce by the income of rent. This the cost to buy will be :

	Purchase price		₹ 22 lakhs
Less:	Saving in fixed cost	2.00	
	Rental income	1.50	3.50
	Relevant cost to buy		18.50

As the cost to buy is less than cost of making, it is advisable to buy it.

Problem 6.13 (*Make or Buy Decision*)

Product *X* takes 20 hours to process on machine 99. It has a selling price of ₹ 100 and marginal cost of ₹ 60. *Y* (a component part used in production) could be made on machine 99 in 3 hours for a marginal cost of ₹ 5. The supplier's price is ₹ 10. Should one make or buy Y? Discuss in both situations (*i*) when machine 99 is working at full capacity and (*ii*) when there is idle capacity.

What are other non-cost considerations to be kept in mind in such cases? *(B.Com., Hons. Delhi)*

Solution

(*i*) When machine 99 is working at full capacity. In this situation, cost of the component *Y* plus contribution lost during the period of manufacture should be compared with supplier's price.

Selling price of *X* =	₹ 100
Less: Marginal cost	60
Contribution	40

Contribution per hour = ₹ 40 ÷ 20 hours = ₹ 2

Cost of making *Y* = Marginal cost + contribution lost

= ₹ 5 + ₹ 6 (3 hrs @ ₹ 2 per hour)

= ₹ 11

Cost of *Y* if bought = ₹ 10.

As the cost of making is more than suppliers price, it is advisable to buy it.

(ii) **When machine 99 has idle capacity.** In this sitination, there will be no loss of contribution when component Y is made because machine will be idle during that period if Y is not made. The cost of making will be only its marginal cost of ₹ 5. As the supplier's price is ₹ 10, it is advisable to make this component Y.

Non-cost considerations

1. Assurance of continued supply, if bought from outside.
2. Adherence to delivery schedule.
3. Assurance of reliable quality.
4. Assurance of no price changes during the period of agreement.

Problem 6.14 (Further Processing Decision)

A food-processing company produces four joint products from a single raw material. These four products are obtained simultaneously at the point of separation. The product R does not require further processing before being taken to the market. The other three products P, Q and S may be further processed before being sold. The company follows the net market value method for allocating common costs to products.

The cost of the raw material used for the year just ended was ₹ 18,000. The initial processing costs were ₹ 30,000 for the same period. The output, sales and further processing costs for the last year were as follows:

Product	*Output (units)*	*Further processing costs (₹)*	*Sales (₹)*
P	4,000	5,000	36,000
Q	3,500	1,750	14,000
R	2,500	—	20,000
S	1,200	3,250	12,000

You are required to:

(*a*) Prepare a Statement of differential cost and Incremental Reverse

(*b*) Assess the change in the profit/loss if a proposal (stated below) made by the top management is accepted.

PROPOSAL: To sell all the products directly to other processors just after separation without any further processing. The expected price per unit for the products are: *P*– ₹ 7, *Q* – ₹ 3.50, *R* – ₹ 8, and *S* –₹ 9.

(*Adapted*)

Solution

Statement of Differential Cost and Incremental Revenue

Product	*Sales after further processing* ₹	*Number of units*	*Selling price before further processing* ₹	*Sales before further processing* ₹	*Incremental revenue* ₹	*Differential cost (Further processing cost)* ₹
	(1)	(2)	(3)	(4) = 2 × 3	(5) = 1 – 4	
P	36,000	4,000	7.00	28,000	8,000	5,000
Q	14,000	3,500	3.50	12,250	1,750	1,750
R	20,000	2,500	8.00	20,000	—	—
S	12,000	1,200	9.00	10,800	1,200	3,250
Total					10,950	10,000

Conclusion: Incremental revenue from further processing is higher at ₹ 10,950 than differential cost at ₹ 10,000 resulting in additional profit of ₹ 950. Thus, as a package, the products may be processed further. But if considered individually, only product P should be processed further and the remaining products should

be sold at split off point. This is because only in cost of P, incremental revenue of ₹ 8,000 is more than differential cost of ₹ 5,000. In case of Q, incremental revenue and differential cost are equal at ₹ 1,750. In case of S, differential cost of ₹ 3,250 is higher than incremental revenue of ₹ 1,200, resulting in a loss.

Problem 6.15 (*Sales Mix Decision*)

A multi-product company provides the following costs and output data for the last year.

	Products		
	X	*Y*	*Z*
Sales mix	40%	35%	25%
	₹	₹	₹
Selling price	20	25	30
Variable cost per unit	10	15	18
Total fixed cost			₹ 1,50,000
Total sales			₹ 5,00,000

The company proposes to replace Product *Z* by Product S. Estimated cost and output data are :

	X	*Y*	*S*	
Sales mix	*50%*	*30%*	*20%*	
	₹	₹	₹	
Selling price	20	25	28	
Variable cost per unit	10	15	14	
Total fixed cost				₹ 1,50,000
Total sales				₹ 5,00,000

Analyses the proposed change and suggest what decision the Company should take.

(I.C.W.A. Inter)

Solution

Present Position

	Products			
	X	*Y*	*Z*	*Total*
Selling price ₹	20	25	30	
Less: Variable cost ₹	10	15	18	
Contribution ₹	10	10	12	
P/V ratio	50%	40%	40%	
Sales mix	40%	35%	25%	100%
Sales ₹	2,00,000	1,75,000	1,25,000	5,00,000
Contribution (Sales × P/V ratio) ₹	1,00,000	70,000	50,000	2,20,000
Less: Fixed cost ₹				1,50,000
Profit ₹				70,000
B.E. Point (₹ 1,50,000 ÷ 44%*)				₹ 3,40,909

*Overall P/V ratio = $\frac{2,20,000}{5,00,000} \times 100 = 44\%$

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Proposed Position

	Products			
	X	*Y*	*S*	*Total*
Selling price ₹	20	25	28	
Less: Variable cost ₹	10	15	14	
Contribution ₹	10	10	14	
P/V ratio	50%	40%	50%	
Sales mix	50%	30%	20%	100%
Sales ₹	2,50,000	1,50,000	1,00,000	5,00,000
Contribution (Sales × P/V ratio)	1,25,000	60,000	50,000	2,35,000
Fixed cost ₹				1,50,000
Profit			₹	85,000
B.E. Point (₹ 1,50,000 ÷ 47%*)			₹	3,19,149

*Overall P/V ratio = $\frac{2,35,000}{5,00,000} \times 100 = 47\%$

Conclusion. It may thus, be concluded that the proposed change should be acceptable because replacement of Product Z by Product *S* will :

(*a*) increase profit by ₹ 15,000 (*i.e.*, 85,000 – 70,000);
(*b*) bring down B.E. point from ₹ 3,40,909 to ₹ 3,19,149.

Problem 6.16 (*Sales Mix Decision*)

Three products *X*, *Y* and *Z* are made and sold by a company. The relevant information is given below :

		Products		
		X	*Y*	*Z*
		₹	₹	₹
Standard costs :				
Direct materials		50	120	90
Variable overheads		12	7	16
Direct labour	Rate per hour	Hours	Hours	Hours
Department *A*	₹ 5	14	8	15
Department *B*	₹ 6	4	3	5
Department *C*	₹ 4	8	4	15

Total fixed overheads for the year are ₹ 3,00,000. The budget for the current financial year, which is prepared for a recessionary period, is based on the following sales:

Product	*Sales (units)*	*Selling price per unit* ₹
X	7,500	210
Y	6,000	220
Z	6,000	300

You are required to show in the form of a statement for management, the unit variable cost of the three products and the total profit expected for the current year. Which of these products is the most profitable? Rank the products. *(C.S. Inter Adapted)*

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Solution

Profitability Statement

Particulars	Products X		Y		Z		Total
		₹		₹		₹	₹
Direct materials		50		120		90	
Variable overhead		12		7		16	
Direct labour:							
Department *A*	70		40		75		
Department *B*	24		18		30		
Department *C*	32	126	16	74	60	165	
Total Variable cost		188		201		271	
Sales Price		210		220		300	
Contribution p.u.		22		19		29	
Units sold		7,500		6,000		6,000	
Total Contribution		1,65,000		1,14,000		1,74,000	4,53,000
Less: Fixed Cost							3,00,000
Profit							1,53,000
Ranking		II		III		I	

Conclusion. Product *Z* is the most profitable as it gives the highest amount of contribution per unit.

Problem 6.17 (*Sales Mix Decision*)

A manufacturing company produces and sells three produces *P*, *Q* and *R*. It has an available machine hour capacity of one lakh hours, interchangeable among the three products. Presently, the company produces and sells 20,000 units of *P* and 15,000 each of *Q* and *R*. The unit selling price of the three products are ₹ 25, ₹ 32 and ₹ 42 for *P*, *Q* and *R* respectively. With this price structure and the aforesaid sales-mix, the company is incurring loss. The total expenditure, exclusive of fixed charges (presently ₹ 5 per unit), is ₹ 13.75 lakhs. The unit cost ratio amongst the products *P*, *Q* and *R* is 4 : 6 : 7. Since the company desires to improve its profitability without changing its cost and price structures, it has been considering the following three mixes so as to be within its total available capacity.

Products	*Mix I* (in units)	*Mix II* (in units)	*Mix III* (in units)
P	25,000	20,000	30,000
Q	15,000	12,000	5,000
R	10,000	18,000	15,000

You are required to compute the quantum of loss now being incurred and advise the most profitable mix which could be considered by the company. (*I.C.W.A. Inter*)

Solution

Variable cost per unit is calculated as under:

Product	*Output units*	*Cost ratio*	*Equivalent units*
P	20,000	4	80,000
Q	15,000	6	90,000
R	15,000	7	1,05,000
Total	50,000		2,75,000

Total variable cost — ₹ 13,75,000
Variable cost per equivalent unit = 13,75,000 ÷ 2,75,000 units = ₹ 5
Variable cost of P = 4 × 5 = ₹ 20 per unit
Q = 6 × 5 = ₹ 30 per unit
R = 7 × 5 = ₹ 35 per unit.

Contribution per unit	P = 25 - 20 = ₹ 5		
	Q = 32 - 30 = ₹ 2		
	R = 42 - 35 = ₹ 7		
Total contribution	P = 20,000 units × ₹ 5	=	1,00,000
	Q = 15,000 units × ₹ 2	=	30,000
	R = 15,000 units × ₹ 7	=	1,05,000
			2,35,000
Less: Total fixed cost @ ₹ 5 for 50,000 units			2,50,000
		Loss	15,000

Comparative Statement of Profitability

	Mixes		
	I	*II.*	*III*
	₹	₹	₹
Contribution P @ ₹ 5	1,25,000	1,00,000	1,50,000
Q @ ₹ 2	30,000	24,000	10,000
R @ ₹ 7	70,000	1,26,000	1,05,000
Total	2,25,000	2,50,000	2,65,000
Less: Fixed cost	2,50,000	2,50,000	2,50,000
Profit/Loss (-)	25,000(-)	Nil	15,000

Conclusion. Mix III is the most profitable as it gives profit.

Problem 6.18 (*Sales Mix and Key Factor*)

The Cost Accountant of a company running an orchard with an adequate supply of labour, presents the following data and requests you to advise about the area to be allotted for the cultivation of various types of fruits, which would result in maximisation of profits. The company contemplates growing apples, lemons, oranges and peaches.

	Apples	*Lemons*	*Oranges*	*Peaches*
Selling price per box (₹)	15	15	30	45
Season's yield in boxes per acre	500	150	100	200
Cost:	₹	₹	₹	₹
Material per acre	270	105	90	150
Labour : Growing per acre	300	225	150	195
Picking and packing per box	1.50	1.50	3	4.50
Transport per box	3	3	1.50	4.50

The total fixed costs in each season would be ₹ 2,10,000.

The following limitations are also placed before you:

(*a*) The area available is 450 acres, but out of this 300 acres are suitable for growing only oranges and lemons. The balance of 150 acres is suitable for growing any of the four fruits.

(*b*) As the produce may be hypothecated to banks, area allotted for any fruit should be demarcated in complete acres and not in fractions of an acre.

(*c*) The marketing strategy of the company requires the compulsory production of all the four types of fruits in a season and the minimum quantity of any one type to be 18,000 boxes.

Calculate the total profit that would accrue if your advice is followed. (*B.Com. Hons., Delhi*)

Solution

Comparative Profitability Statement

		Apples	*Lemons*	*Oranges*	*Peaches*
(A)	Selling price per box (₹)	15	15	30	45
(B)	Season's yield in boxes per acre	500	150	100	200
		₹	₹	₹	₹
(C)	Sales per acre ($A \times B$)	7,500	2,250	3,000	9,000
	Variable costs per acre:				
	Material	270	105	90	150
	Growing labour	300	225	150	195
	*Picking and packing costs	750	225	300	900
	*Transport per acre	1,500	450	150	900
(D)	Variable cost	2,820	1,005	690	2,145
(E)	Contribution ($C - D$)	4,680	1,245	2,310	6,855
	Ranking	II	IV	III	I
	Minimum acres to be allotted	$= \frac{18,000}{500}$	$= \frac{18,000}{150}$	$= \frac{18,000}{100}$	$= \frac{18,000}{200}$
		= 36	= 120	= 180	= 90
	Acres allotted out of 450 acres	36	120	180	90+24 = 114
	Total Contribution (Contribution per acre × Acres allotted)	1,68,480	1,49,400	4,15,800	7,81,470

Total contribution of all products

= (1,68,480 + 1,49,400 + 4,15,800 + 7,81,470) = ₹ 15,15,150

Net Profit = Contribution – Fixed cost

= 15,15,150 – 2,10,000 = **₹ 13,05,150.**

***Note.** Picking and packing cost and also transport cost is calculated by multiplying number of boxes by the cost per box.

Problem 6.19 (*Sales Mix and Key Factor*)

A farmer asks your recommendation for optimal mix of production for the coming year. The current data is given below :

Particulars	*Items produced*			
	A	*B*	*C*	*D*
Area occupied (acres)	25	20	30	25
Yield per acre (tonnes)	10	8	9	12
Sale price per tonne (₹)	1,000	1,250	1,500	1,350

Variable cost per, acre:				
Material (₹)	700	600	950	900
Labour (₹)	2,000	2,500	3,000	3,700
Variable overhead (₹)	2,000	2,000	2,000	2,000
	₹			
Fixed overheads:				
Cultivation and growing	1,00,000			
Harvesting and transport	2,40,000			
Land revenue	90,000			
Administration	1,10,000			
	5,40,000			

The land which is being used for production items *A* and *B* can be used for either items but not items *C* and *D*. The land which is being used for producing items *C* and *D* can be used for either items but not for items *A* and *B*.

In order to provide adequate market service, the farmer must produce each year at least 40 tonnes each of *A* and *B* and 36 tonnes each of *C* and *D*.

You are required to calculate the following :

(*i*) the profit for the current year; and

(*ii*) the profit for the production mix which you would recommend. (*B. Com*)

Solution

Profitability Statement for the current year

	A	*B*	*C*	*D*
Sales per acre (₹)	10,000	10,000	13,500	16,200
(Selling price × yield per acre)				
Less: Variable cost (₹)	4,700	5,100	5,950	6,600
(*a*) Contribution per acre (₹)	5,300	4,900	7,550	9,600
(*b*) Total acres	25	20	30	25
Total contribution (*a* × *b*)	1,32,500	98,000	2,26,500	2,40,000
Total Contribution (*A* + *B* + *C* + *D*)				6,97,000
Less: Fixed cost				5,40,000
Current profit				1,57,000

Profitability Statement

(For the recommended product mix)

	A	*B*	*C*	*D*
(*a*) Minimum production (Tonnes)	40	40	36	36
(*b*) Yield per acre (Tonnes)	10	8	9	12
(*c*) Minimum acres allotted (a ÷ b)	4	5	4	3
(*d*) Surplus acres allotted*	36	—	—	48
(*e*) Total acres (c + d)	40	5	4	51
(*f*) Contribution per acre (₹)	5,300	4,900	7,550	9,600
(*g*) Total contribution (e × f) ₹	2,12,000	24,500	30,200	4,89,600
Total contribution of all products *A* + *B* + *C* + *D*			₹	7,56,300
Less: Fixed cost				5,40,000
Current Profit				2,16,300

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***Working Note:**

Total acres allotted to *A* and *B* is 45, *i.e.*, 25 + 20, out of which minimum area is 4 and 5 acres for *A* and *B*. Since contribution per acre per *A* is more than *B*. The remaining 36 acres are allotted to *A*. Similarly total area allotted to *C* and *D* is 55 acres, *i.e.*, 30 + 25, out of which minimum area is 4 and 3 acre for *C* and *D* respectively. Since *D* is more profitable than *C*, the remaining 48 acres are allotted to *D*.

Problem 6.20 (*Sales Mix and Key Factor*)

XYZ Ltd. which produces three products furnishes you the following data for the year 2017.

	Products		
	A	*B*	*C*
Selling price per unit (₹)	100	75	50
Profit/Volume ratio	10%	20%	40%
Maximum sales potential (units)	40,000	25,000	10,000
Raw material content as percentage of variable costs	50%	50%	50%

The fixed expenses are estimated at ₹ 6,80,000. The company uses a single raw material in all the three products. Raw material is in short supply and the company has a quota for the supply of raw materials of the value of ₹ 18,00,000 for the year for the manufacture of its products to meet its sales demand.

You are required to (*i*) set a product mix which will give the maximum overall profit keeping the short supply of raw material in view. (*ii*) compute that maximum profit. (*B.Com. Hons., Delhi*)

Solution

Profitability Statement

		Products		
		A	*B*	*C*
(*a*)	Selling price ₹	100	75	50
(*b*)	P/V ratio	10%	20%	40%
(*c*)	Contribution per unit (a × b) ₹	10	15	20
(*d*)	Variable cost per unit (a – c) ₹	90	60	30
(*e*)	Raw material per unit (d ÷ 2) ₹	45	30	15
(*f*)	Contribution per Re 1 of raw material (c ÷ e)	Re 0.22	0.50	1.33
	Ranking	**III**	**II**	**I**

Statement of Product Mix and Profit

Products	*No. of units*	*Material cost per unit*	*Total material cost* ₹		*Contribution per unit* ₹	*Total Contribution*
C	10,000	15	1,50,000		20	2,00,000
B	25,000	30	7,50,000		15	3,75,000
A	20,000	45	9,00,000	(Balance)	10	2,00,000
				Total		7,75,000
			Less: Fixed cost			6,80,000
			Profit			**95,000**

Problem 6.21 (Sales Mix and Key Factor)

A company produces three products. The cost data are as under :

		A	B	C
Direct materials		₹ 64	152	117
Direct labour :	Rate per hour	Hrs.	Hrs.	Hrs.
Dept.	₹			
1	5	18	10	20
2	6	5	4	7
3	4	10	5	20
Variable overheads		₹ 16	9	21
Fixed overheads		₹ 4,00,000 per annum		

The budget was prepared at a time when the market was sluggish. The budgeted quantities and selling prices are as under :

Product	Budgeted Qty.	Selling Price (₹)/Unit
A	9,750 units	270
B	7,800 units	280
C	7,800 units	400

Later the market improved and the sales quantities could be increased by 20% for product *A* and 25% each for products *B* and *C*. The sales manager confirmed that the increased quantities could be achieved at the prices originally budgeted. The production manager stated that the output cannot be increased beyond the budgeted level due to limitation of direct labour hours in Department 2.

Required :

(*i*) Present a statement of budgeted profitability.

(*ii*) Set optimal product mix and calculate the optimal profit. *(C.A. Inter)*

Solution

(i) **Statement of Budgeted Profitability**

	Products			Total
	A	B	C	₹
Budgeted quantity (units)	9,750	7,800	7,800	
	₹	₹	₹	
(A) Selling price per unit	270	280	400	
Variable costs:				
D. Materials	64	152	117	
D. Labour	160	94	222	
Variable overhead	16	9	21	
(B) Total variable cost	240	255	360	
(C) Contribution (*A* – *B*)	30	25	40	
Total contribution	9,750 × 30	7,800 × 25	7,800 × 40	
	= 2,92,500	= 1,95,000	= 3,12,000	7,99,500
Less: Fixed Cost				4,00,000
Budgeted Profit				3,99,500

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(ii) **Statement of Profitability with Optimal Mix**

	A	B	C
(A) Contribution per unit (₹)	30	25	40
(B) Labour hrs in Dept. 2	5	4	7
(C) Contribution per hour (A ÷ B) ₹	6	6.25	5.71
Ranking	II	I	III
Optional product mix*	11,700	9,750	5,292 (Balance)
	(58,500 hrs)	(39,000 hrs)	(37,044 hrs)
Total contribution for optimal mix (₹)	3,51,000	2,43,750	2,11,680
Total Contribution of A, B and C = ₹ 8,06,430 (3,51,000 + 2,43,750 + 2,11,680)			
Less : Fixed Cost	4,00,000		
Profit	4,06,430		

***Note**

Total hrs in Dept. 2 are calculated as follows :

Product (A)	*Units* (B)	*Hours per unit* (C)	*Total hours.* (B × C)
A	9,750	5	48,750
B	7,800	4	31,200
C	7,800	7	54,600
Total			1,34,550

*Maximum sales quantities:

A = 9,750 units + 20% = 11,700 units
B = 7,800 units + 25% = 9,750 units
C = 7,800 units + 25% = 9,750 units

Problem 6.22 (*Sales Mix and Key Factor*)

X Y Ltd. is manufacturing three household products *A*, *B* and *C*, and selling them in a competitive market. Details of current demand, selling price and cost structure are given below :

	A	B	C
Expected demand (units)	10,000	12,000	20,000
Selling price per unit (₹)	20	16	10
Variable cost per unit (₹) –			
Direct materials (₹ 10/kg.)	6	4	2
Direct labour (₹ 15/hr.)	3	3	1.50
Variable overheads	2	1	1
Fixed overhead per unit (₹)	5	4	2

The company is frequently affected by acute scarcity of raw material and high labour turnover. During the next period, it is expected to have one of the following situations :

(*a*) Raw materials available will be only 12,100 kg.

(*b*) Direct labour hours available will be only 5,000 hrs.

(*c*) It may be possible to increase sales of any one product by 25% without any additional fixed costs but by spending ₹ 20,000 on advertisement. There will be no shortage of materials or labour.

Suggest the best production plan in each case and the resultant profit that the company would earn according to your suggestion.

Solution

Profitability Statement

	Products		
	A	*B*	*C*
	₹	₹	₹
Selling price per unit	20	16	10
Variable costs:			
Material	6	4	2
Labour	3	3	1.50
Variable overhead	2	1	1
Variable cost per unit	11	8	4.50
Contribution per unit	9	8	5.50
P/V ratio	45%	50%	55%
Ranking	III	II	I
When raw material is the key factor			
Raw material required per unit (kg)	0.60	0.40	0.20
(Material cost ÷ price per kg)			
Contribution per kg of raw material ₹	15	20	27.50
Ranking	III	II	I
When labour time is the key factor			
Labour hours required per unit	1/5	1/5	1/10
(Labour cost ÷ wages per hour)			
Contribution per labour hour ₹	45	40	55
Ranking	II	III	I

Calculation of total fixed cost

A = 10,000 units × ₹ 5	= ₹ 50,000
B = 12,000 units × ₹ 4	48,000
C = 20,000 units × ₹ 2	40,000
Total fixed cost	₹ 1,38,000

(a) ***Product mix, when raw material is available only 12,100 kg.***

Product	*No. of units*	*Raw material required (kg)*	*Contribution per unit (₹)*	*Total contribution* ₹
C	20,000	4,000	5.50	1,10,000
B	12,000	4,800	8.00	96,000
A (Balance)	5,500	3,300	9.00	49,500
			Total	2,55,500
Less: Fixed cost				1,38,000
			Profit	1,17,500

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(b) **Product mix when labour hours available only 5,000**

Product	No. of units	Labour hours required	Contribution per unit ₹	Total contribution ₹
C	20,000	2,000	5.50	1,10,000
A	10,000	2,000	9.00	90,000
B (Balance)	5,000	1,000	8.00	40,000
Total				2,40,000
Less Fixed Cost				1,38,000
			Profit	1,02,000

(c) **When there is no shortage of material and labour,** C is the most profitable product and thus this product should be selected for 25% increase in production and sale. Additional contribution from its sale of extra 5,000 units (25% of 20,000 units) is

5,000 units × ₹ 5.50 = ₹ 27,500

Product mix

Product	No. of units	Contribution per unit	Total contribution
A	10,000	9	90,000
B	12,000	8	96,000
C	25,000	5.50	1,37,500
			3,23,500
Total		1,38,000	
Less: Fixed cost			
Advertisement		20,000	1,58,000
Profit			1,65,000

Problem 6.23 (*Sales Mix Decision and Key Factor*)

A company can produce three different products from the same raw material using same production facilities. The requisite labour is available in plenty at ₹ 8 per hour for all products. The supply of raw material,which is imported at ₹ 8 per kg. is limited to 10,400 kg. for the budget period. The variable overheads are ₹ 5.60 per hour. The fixed overheads are ₹ 50,000. The selling commission is 10% on sales.

(*a*) From the following information, you are required to suggest the most suitable sales mix, which will maximise the company's profit. Also, determine the profit that will be earned at that level.

Product	Market demand units	Selling price per unit ₹	Labour hours per unit	Raw material required per unit (kg.)
X	8,000	30	1	0.7
Y	6,000	40	2	0.4
Z	5,000	50	1.5	1.5

(*b*) Assume, in above situation, if additional 4,500 kg. of raw material is made available for production, should the company go in for further production, if it will result in additional fixed overheads of ₹ 20,000 and 25% increase in the rates per hour for labour and variable overheads. (*B.Com. Hons., Delhi; C.A. Inter*)

Solution

Statement of Marginal Cost and Contribution

	(Per unit of products)		
	X	*Y*	*Z*
	₹	₹	₹
Direct materials @ ₹ 8 per kg.	5.60	3.20	12.00
Direct wages @ ₹ 8 per hr.	8.00	16.00	12.00
Variable overhead @ ₹ 5.60 per hr.	5.60	11.20	8.40
Sales commission @ 10% on Selling price	3.00	4.00	5.00
(A) **Marginal Cost**	22.20	34.40	37.40
(B) Selling Price	30.00	40.00	50.00
(C) Contribution (*B* – *A*)	7.80	5.60	12.60
(D) Raw-material per unit (kg.)	0.70	0.40	1.50
(E) Contribution per kg. of raw-material (*C* ÷ *D*) ₹	11.14	14.00	8.40
Ranking	II	I	III

Statement of Suggested Sales Mix and Profit

Product	*Units produced*	*Raw material per unit (kg.)*	*Raw material consumed (kg.)*	*Contribution* ₹
Y	6,000	0.4	2,400	2,400 kg. × ₹ 14 = ₹ 33,600
X	8,000	0.7	5,600	5,600 kg. × ₹ 11.14 = ₹ 62,384
Z	(Balance) 1,600	1.5	2,400	2,400 kg. × ₹ 8.40 = ₹ 20,160
	Total contribution (33,600 + 62,384 + 20,160)			1,16,144
Less:	Fixed overhead			50,000
	Profit			₹ 66,144

(*b*) Availability of additional 4,500 kg. of raw material will be used to produce 4,500 ÷ 1.5 = 3,000 units of product *Z* because the market demand of *Y* and *X* products has already been fully met. Additional profit from this additional production of product Z is computed as shown below :

			₹
	Additional contribution (3,000 units @ ₹ 12.60)		37,800
Less:	Additional costs		
	Labour (3,000 × ₹ 5.60 × 25%)	9,000	
	Variable overhead (3,000 × ₹ 5.60 × 25%)	6,300	15,300
	Additional net contribution		22,500
Less:	Additional fixed overheads		20,000
	Additional Profit		2,500

Conclusion. The company should go in for the additional production of 3,000 units of Z product from additional availability of raw material because it will add ₹ 2,500 to the profits of the company.

Problem 6.24 (*Sales Mix with Key Factor*)

From the following particulars, find the most profitable product mix and prepare a statement of profitability of that product-mix :

	Product A	Product B	Product C
Units budgeted to be produced and sold	1,800	3,000	1,200
Selling Price per unit (₹)	60	55	50
Direct material required per unit (kg)	5	3	4
Direct labour per unit (hrs.)	4	3	4
Variable overheads (₹)	7	13	2
Fixed overheads (₹)	10	10	8
Cost of direct material per kg (₹)	4	4	10
Direct labour hour rate (₹)	2	2	4
Maximum possible units of sale	4,000	5,000	2
			1,500

All the three products are produced from the same direct material using the same type of machines and labour. Direct labour which is the key factor is limited to 18,600 hours. *(B.Com. Hons., Delhi)*

Solution

Profitabiltiy Statement

	A ₹	B ₹	C ₹	Total ₹
Selling Price	60	55	50	
Direct material	20	12	16	
Direct labour	8	6	4	
Variable overheads	7	13	8	
Variable cost	35	31	28	
Contribution (a)	25	24	22	
Labour hrs. per unit (b)	4	3	2	
Contribution per labour hour (a÷b)	6.25	8	11	
Ranking	III	II	I	
Units produced* (c)	150	5,000	1,500	
Contribution (total) (a × c)	3,750	1,20,000	33,000	1,56,750
Less: Fixed Cost**				60,000
Profit				96,750

***Suggested sales mix** - Labour hour being the key factor

Rank I - Product *C* - 1,500 units × 2 hours	=	3,000 hrs.
II - Product *B* - 5,000 units × 3 hours	=	15000 hrs.
III - Product *A* - 150 units × 4 hours (Balance)	=	600 hrs.
Total labour hours	=	18,600 hrs.

****Calculation of fixed cost**

Product *A* - 1800 units × ₹ 10	=	₹ 18,000
Product *B* - 3000 units × ₹ 10	=	₹ 30,000
Product *C* - 1200 units × ₹ 10	=	₹ 12,000
Total fixed cost	=	₹ 60,000

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Problem 6.25 (Sales Mix Decision)

(a) The following particulars are taken from the records of a company engaged in manufacturing two products, A and B, from a certain material :

	Product A (per unit) ₹	Product B (per unit) ₹
Sales	2,500	5,000
Material cost (₹ 50 per kg)	500	1,250
Direct labour (₹ 30 per hour)	750	1,500
Variable overhead	250	500
Total fixed overheads: ₹ 10,00,000		

Comment on the profitability of each product when :

(i) Total sales in value is limited.

(ii) Raw materials is in short supply.

(iii) Production capacity is the limiting factor.

(iv) Total availability of raw materials is 20,000 kg. and maximum sales potential of each product is 1,000 units, find the product mix to yield maximum profits. *(C.A. Inter)*

Solution

Profitability Statement

		Products A	Products B
(A) Selling price per unit	₹	2,500	5,000
Material cost	₹	500	1,250
Direct labour	₹	750	1,500
Variable overhead	₹	250	500
(B) Variable cost	₹	1,500	3,250
Contribution (A – B)	₹	1,000	1,750
P/V ratio (C/S)		40%	35%
Raw material consumed		₹ 500 ÷ 50 = 10 kg	₹ 1250 ÷ 50 = 25 kg
Contribution per kg of material		₹ 1,000 ÷ 10 kg = ₹ 100	₹ 1,750 ÷ 25 kg = ₹ 70
Direct labour hours		₹ 750 ÷ 30 = 25 hrs	₹ 1,500 ÷ 30 = 50 hrs
Contribution per hour		₹ 1,000 ÷ 25 hrs = ₹ 40	₹ 1,750 ÷ 50 hrs = ₹ 35

Comments:

(i) *When sales value is limited* — Product A is more profitable because its P/V ratio is higher.

(ii) *When raw material is in short supply* — Product A is more profitable because its contribution per kg. of raw material is higher.

(iii) When production capacity is the limiting factor, product A is more profitable because its contribution per hour is higher.

(iv) When raw material is in short supply, product *A* is more profitable and thus production of *A* should be maximised. It consumes 10 kg. of raw material per unit. Thus maximum production of *A* upto

1,000 units will consume (1000 units @ 10 kg.) 10,000 kg of raw materials. Remaining 10,000 kg should by utilised to manufacture 400 units of product B (*i.e.*, 10,000 kg ÷ 25 kg)

Thus 1,000 units of A and 400 units of B is the product mix which yield maximum profit.

	₹
Contribution from Product A = 1,000 units × ₹ 1,000	= 10,00,000
Contribution from product B = 400 units × ₹ 1,750	= 7,00,000
Total Contribution	17,00,000
Less: Fixed Cost	10,00,000
Profit	7,00,000

Problem 6.26 (*Product Priorities*)

A company manufactures and markets three products *X*, *Y* and *Z*. All the three products are made from the same set of machines. Production is limited by machine capacity. From the data given below, indicate priorities for products *X*, *Y* and *Z* with a view to maximising profits :

	Products		
	X	*Y*	*Z*
Raw material cost per unit (₹)	11.25	16.25	21.25
Direct labour cost per unit (₹)	2.50	2.50	2.50
Other variable cost per unit (₹)	1.50	2.25	3.55
Selling price per unit (₹)	25.00	30.00	35.00
Standard machine time required per unit (in minutes)	39	20	28

(C.A. Inter)

Solution

Profitability Statement

	Products		
	X ₹	*Y* ₹	*Z* ₹
(A) Selling price per unit	25	30	35
Raw material	11.25	16.25	21.25
Direct labour	2.50	2.50	2.50
Other variables	1.50	2.25	3.55
(B) Variable cost per unit	15.25	21.00	27.30
(C) Contribution (*A* – *B*)	9.75	9.00	7.70
(D) St. machine time in minutes	39	20	28
(E) Contribution per minute (*C* ÷ *D*)	0.25	0.45	0.275
Product priorities (Ranking)	**III**	**I**	**II**

Problem 6.27 (*Sales Mix Decision*)

The budgeted results of *A* Ltd. are as under :

Product	*Sales Value* (₹)	*P/V Ratio* (%)
X	2,50,000	50
Y	4,00,000	40
Z	6,00,000	30

Fixed overheads for the period ₹ 5,02,200. The management is worried about the results. You are required to prepare a statement showing the amount of loss, if any, being incurred at present and recommend a change in the sales value of each product as well as in the total sales value maintaining the same sales-mix, which will eliminate the said loss.

(C.A. Inter)

Solution

Statement Showing the Present Loss

Product	Sales Value × P/V Ratio	Contribution (₹)
X	₹ 2,50,000 × 50%	1,25,000
Y	₹ 4,00,000 × 40%	1,60,000
Z	₹ 6,00,000 × 30%	1,80,000
Total	₹ 12,50,000	4,65,000
Less: Total fixed overheads		5,02,200
Total loss		(37,200)

For eliminating this loss, an additional contribution of ₹ 37,200 is required.

Maintaining the same sales mix means that the ratio of sales value of X,Y and Z should remain unchanged.

$$\text{Overall P/V ratio} = \frac{\text{Total contribution}}{\text{Total sales}} = \frac{4,65,000}{12,50,000} \times 100 = 37.2\%$$

Additional sales to earn additional contribution of ₹ 37,200

$$= \frac{\text{Additional contribution}}{\text{Combined P/V ratio}} = \frac{37,200}{37.20\%} = ₹\,1,00,000$$

Additional sales of ₹ 1,00,000 should be in the old ratio of sales, 25 : 40 : 60 for X, Y, and Z, i.e., X ₹ 20,000, Y ₹ 32,000 and Z ₹ 48,000.

Problem 6.28 (Sales Mix and Key Factor)

A company producing products PIE and SIGMA using a single production process has the following cost data:

	PIE	SIGMA
Selling price per unit (₹)	20	30
Variable cost per unit (₹)	11	16
Machine hours required per unit of production (hrs.)	1	2
Market limitation (units)	1 lakh	2.5 lakhs

Total machine hours available — 4 lakhs

Fixed cost per annum — ₹ 26 lakhs

Considering the limiting factors of machine hours and market limitations, you are required to:

(a) indicate the best combination of products to give optimum contribution;

(b) show the additional machinery requirement to be augmented on rental basis at an annual rent of ₹ 1.5 lakhs per machine to provide additional capacity of 30,000 hours per machine;

(c) change in number of machines to be rented if the annual rental charges reduce to ₹ 1,25,000 per machine.

(I.C.W.A. Inter)

Solution

Marginal Cost Statement

	Per unit of	
	PIE	*SIGMA*
Selling price ₹	20	30
Less: Variable cost ₹	11	16
Contribution	9	14
Machine hours	1	2
Contribution per machine hour ₹	9 ÷ 1 = 9	14 ÷ 2 = 7
Product priorities	I	II

Machine time being the key factor, product PIE is more profitable because it gives a higher contribution per machine hour.

Product Mix — Taking into account market limitation, maximum of 1,00,000 units of PIE should be sold which will utilise 1,00,000 hours. Balance hours available for Sigma = 4 lakhs – 1 lakh = 3,00,000 hrs.

No. of units of Sigma that may be produced = 3,00,000 ÷ 2 = 1,50,000 units

(a) Contribution from the best product mix

PIE	1,00,000 units @ ₹ 9 per unit	=	₹ 9,00,000
SIGMA	1,50,000 units @ ₹ 14 per unit	=	₹ 21,00,000
	Total Contribution		30,00,000

(b) Additional machines on rental basis.

Units of Sigma yet to be produced 1,00,000 units.

Machine hours required 2,00,000 hours.

No. of machiness @ 30,000 hours per machine 6 + 1 = 7 machines

Of the seven machines, 6 machines can be fully utilised to provide 1,80,000 hrs giving a contribution of ₹ 2,10,000 per machine against its rent of ₹ 1,50,000. But the 7th machine will give a contribution of only ₹ 1,40,000 because it can be utilised only to the extent of 20,000 hours due to market limitation. This will leave an idle capacity of 10,000 hours. Thus this 7th machine will give a contribution of only ₹ 1,40,000 against machine rental of ₹ 1,50,000 resulting in a loss of ₹ 10,000. Thus only 6 machines should be taken on rent.

(c) When rent per machine is ₹ 1,25,000 per annum, the 7th machine could also be rented out because it will result in a net margin of ₹ 15,000 (*i.e.*, 1,40,000 – 1,25,000).

Fixed cost has not been taken into account because it does not change under different alternatives and thus is not relevant in this case.

Problem 6.29 (*Changes in Price and Volume*)

Reliable Product Co. manufactures product *MK*. The company is expected to show a profit of ₹ 14,00,000 from the production of this product *MK* in the year 2005, after charging fixed cost of ₹ 10,00,000. Product *MK* is sold for ₹ 50 per unit and has a variable cost of ₹ 20 per unit.

Market research suggest the following responses to price charges:

Alternative	*Selling price reduced by*	*Quantity sold increased by*
A	5%	10%
B	7%	20%
C	10%	25%

Evaluate these alternatives and suggest on profitability considerations, which alternative should be adopted for the forthcoming year 2006, assuming there is no change in the cost structure.

(B.Com. Hons. Delhi; C.A. Inter)

Solution

Total Contribution = F + P = 14,00,000 + 10,00,000 = ₹ 24,00,000.
Contribution per unit = S – V = 50 – 20 = ₹ 30
Quantity produced = ₹ 24,00,000 ÷ ₹ 30 = 80,000 units.

Profitability Statement

	Alternatives		
	A	*B*	*C*
	₹	₹	₹
Selling price	50.00	50.00	50.00
Less: Price reduction	2.50	3.50	5.00
New price	47.50	46.50	45.00
Less: Variable cost	20.00	20.00	20.00
(A) New contribtuon	27.50	26.50	25.00
Sales (units)	80,000	80,000	80,000
Add: Increase	8,000	16,000	20,000
(B) New sales (units)	88,000	96,000	1,00,000
Total Contribution (A × B)	₹ 24,20,000	25,44,000	25,00,000
Less: Fixed cost	10,00,000	10,00,000	10,00,000
Profit	14,20,000	15,44,000	15,00,000

Conclusion. Alternative *B* should be adopted as it results in the largest amount of contribution and profit.

Problem 6.30 (*Introducing a New Product*)

A company produces 30,000 units of product *A* and 20,000 units of product *B* per annum. The sales value and costs of the two products are as follows :

	₹
Sales value	7,60,000
Direct material	1,40,000
Direct labour	1,90,000
Factory overheads	1,90,000
Administrative and selling overheads	1,20,000

50% of factory overheads are variable and 50% of administrative and selling overheads are fixed. The selling price of *A* is ₹ 12 per unit and *B* is ₹ 20 per unit.

The direct material and labour ratio for product *A* is 2 : 3 and for *B* is 4 : 5. For both the products, the selling price is 400% of direct labour. The factory overheads are charged in the ratio of direct labour and administrative and selling overheads are recovered at a flat rate of ₹ 2 per unit of *A* and ₹ 3 per unit of *B*.

Due to fall in demand of the above products, the company has a plan to diversify and make product *C* using 40% capacity. It has been estimated that for *C* direct material and direct labour will be ₹ 2.50 and ₹ 3 per unit respectively. Other variable cost will be same as applicable to product *A*. The selling price of product *C* is ₹ 14 per unit and production will be 30,000 units.

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Assuming 60% capacity is used for manufacture of *A* and *B*, calculate
(*a*) present costs and profit,
(*b*) cost and profit after diversification, and
(*c*) given your recommendation as to whether to diversify or not. (*I.C.W.A. Inter*)

Solution

(*a*) Statement of Present Cost and Profit

	Products				Total
	A		*B*		(*A* + *B*)
Production and sales (units)	30,000		20,000		
	Per unit	Total	Per unit	Total	
	₹	₹	₹	₹	₹
Sales (S)	12	3,60,000	20	4,00,000	7,60,000
Direct materials	2.00	60,000	4.00	80,000	1,40,000
Direct labour (1/4 of S.P.)	3.00	90,000	5.00	1,00,000	1,90,000
Variable overhead :					
Factory	1.50	45,000	2.50	50,000	
Adm. and selling	1.00	30,000	1.50	30,000	
Variable Cost (V)	7.50	2,25,000	13.00	2,60,000	4,85,000
Contribution (S–V)	4.50	1,35,000	7.00	1,40,000	2,75,000
Less : Fixed Cost:					
Factory	95,000				
Adm and selling	60,000				1,55,000
Profit					1,20,000

(*b*) Statement of Cost and Profit (After Diversification)

	Products			Total
	A	*B*	*C*	(*A*+*B*+*C*)
Production and sales (units)	18,000	12,000	30,000	
	₹	₹	₹	₹
Sales (S)	2,16,000	2,40,000	4,20,000	8,76,000
Direct material	36,000	48,000	75,000	1,59,000
Direct labour	54,000	60,000	90,000	2,04,000
Variable overhead:				
Factory	27,000	30,000	45,000	1,02,000
Adm. and selling	18,000	18,000	30,000	66,000
Variable cost (V)	1,35,000	1,56,000	2,40,000	5,31,000
Contribution (S – V)	81,000	84,000	1,80,000	3,45,000
Less : Fixed cost :				
Factory	95,000			
Adm and selling	60,000			1,55,000
Profit				1,90,000

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(c) **Recommendation**

	Before diversification	*After diversification*
Profit ₹	1,20,000	1,90,000
P/V ratio	$\frac{2,75,000}{7,60,000} \times 100 = 36.18\%$	$\frac{3,45,000}{8,76,000} \times 100 = 39.38\%$

Diversification has resulted in higher profit of ₹ 1,90,000 and higher P/V ratio at 39.38%. Therefore, diversification plan should be implemented.

Problem 6.31 (Discontinuance of a Product Line)

Pee Kay Ltd. is engaged in 3 distinct lines of production. Their production cost per unit and selling prices are as under :

	A	*B*	*C*
Production (units)	3,000	2,000	5,000
	₹	₹	₹
Material cost	18	26	30
Wages	7	9	10
Variable overheads	2	3	3
Fixed overheads	5	8	9
Total cost	32	46	52
Selling price	40	60	61
Profit	8	14	9

The management wants to discontinue one line and gives you the assurance that production in two other lines shall rise by 50%. They intend to discontinue the line which produces Article *A* as it is less profitable.

(*a*) Do you agree to the scheme in principle? If so, do you think that the line which produces '*A*' should be discontinued.

(*b*) Offer your comments and show the necessary statements to support your decision. (*B.Com., Mumbai*)

Solution

Total Fixed Overheads:

	₹
A (3,000 units @ ₹ 5)	15,000
B (2,000 units @ ₹ 8)	16,000
C (5,000 units @ ₹ 9)	45,000
Total fixed overhead	76,000

Contribution = Selling price – Variable cost

Article *A* = 40 – 27 = ₹ 13 per unit

B = 60 – 38 = ₹ 22 per unit

C = 61 – 43 = ₹ 18 per unit

The decision should be taken on relative profitability of various alternatives as ascertained below : Profits from different production arrangements are shown below :

(*a*) **If '*A*' is given up,** sale of *B* and *C* will increase by 50%. Then the sales would be, *B* – 3,000 units and Article *C* – 7,500 units.

Contribution on *B* = 3,000 × 22 =	₹	66,000
Contribution on *C* = 7,500 × 18 =	₹	1,35,000
Total contribution		2,01,000

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Less: Fixed overheads		76,000
Profit	₹	1,25,000

(*b*) **If 'B' is discontinued,** production of *A* and *C* will increase by 50%, *i.e.*, *A* – 4,500 units and *C* – 7,500 units.

Contribution on *A* = 4,500 × 13 =	₹	58,500
Contribution on *C* = 7,500 × 18 =	₹	1,35,000
Total contribution		1,93,500
Less: Fixed overheads		76,000
Profit	₹	1,17,500

(*c*) **If 'C' is discontinued,** production of *A* will be 4,500 units and that of *B* will be 3,000 units.

Contribution on *A* (4,500 × 13)	₹	58,500
Contribution on *B* (3,000 × 22)	₹	66,000
Total contribution		1,24,500
Less: Fixed overheads		76,000
Profit	₹	48,500

Conclusion. Of the three alternatives, the highest amount of profit (₹ 1,25,000) is earned when A line of production is discontinued. Thus, the management decision to discontinue *A* line is correct.

Problem 6.32 (*Differential Cost Analysis*)

Pioneer Manufacturing Company, makers of a specialized line of toys, received an order for 2,000 units of toy battle tank from a large mail-order house at a price of ₹ 3 per unit.

The company sells this type of toy to its other customers at ₹ 5 each but it has surplus capacity and can take the special order without adversely affecting its regular operations for the coming month.

The income statement of the company for the preceding month is an under:

	₹
Net Sales—10,000 units @ ₹ 5 each	50,000
Costs:	
Direct materials—₹ 1.50 per unit	15,000
Direct labour—₹ 1 per unit	10,000
Factory overhead	10,000
Selling and administrative overheads	10,000
Total costs	45,000
Net Profit	5,000

Direct material and direct labour costs to be incurred on the special order are estimated to be of the same amount per unit as for the regular business. Special tools costing ₹ 500 would be required to meet the specifications of the mail-order house.

You are required to prepare a Differential Costs Statement for deciding about the acceptance of the order.

(*B.Com. Hons., Delhi*)

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Solution

Differential Cost Statement

	For 10,000 unit ₹	For 12,000 units ₹	Differential Cost ₹
Direct materials	15,000	18,000	3,000
Direct labour	10,000	12,000	2,000
Factory overhead	10,000	10,000	—
Selling & Adm. Ohd.	10,000	10,000	—
Special tools	—	500	500
Total cost	45,000	50,500	5,500
Sales	50,000	56,000	6,000

Conclusion. Increase in sales is ₹ 6,000 while increase in cost is only ₹ 5,500. The special order should be accepted as it will result in increase in profit of ₹ 500.

Problem 6.33 (*Differential Cost Analysis*)

A Company at present working at 90% capacity and producing 13,500 units per year. It operates a flexible budgetary control system. The following figures are obtained from its budget.

	90% ₹	100% ₹
Sales	15,00,000	16,00,000
Fixed expenses	3,00,500	3,00,600
Variable expenses	1,45,000	1,49,500
Semi-fixed expenses	97,500	1,00,400
Units manufactured	13,500	15,000

Labour and material cost per unit are constant under present conditions. Profit margin is 10% of sales at 90% capacity.

(*a*) You are required to determine the differential cost of producing 1,500 units by increasing capacity to 100%.

(*b*) What price would you recommend for export of these 1,500 units, taking into account that overseas prices are much lower than indigenous prices. (*B.Com. Hons., Delhi*)

Solution

The problem does not give the material and labour cost which is needed for computing differential cost. It is computed by working backward from sales as follows:

		At 90% capacity ₹
Sales (13,500 units)		15,00,000
Less: Profit (10% of sales)		1,50,000
Cost of goods sold		13,50,000
Less: Variable expenses	1,45,000	
Semi-fixed expenses	97,500	
Fixed expenses	3,00,500	5,43,000
Cost of labour and material (Prime cost)		8,07,000

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Labour and material costs are variable in nature and thus at 100% capacity these will be calculated as under:

$$8,07,000 \times \frac{100}{90} = ₹\ 8,96,667 \text{ (approx.)}$$

Statement of Differential Cost Analysis

	90%	100%	Differential
Production (units)	13,500	15,000	1,500
Labour and material cost	₹ 8,07,000	8,96,667	89,667
Variable expenses	₹ 1,45,000	1,49,500	4,500
Semi-fixed expenses	₹ 97,500	1,00,400	2,900
Fixed expenses	₹ 3,00,500	3,00,600	100
Total	13,50,000	14,47,167	97,167

$$\text{Differential cost per unit} = \frac{\textit{Differential cost}}{\textit{Differential units}} = \frac{\textit{Rs. 97,167}}{\textit{1,500 units}} = ₹\ \mathbf{64.78}$$

At a price of ₹ 64.78, there will be no additional profit. Therefore, any price above ₹ 64.78 which gives at least reasonable profit should be acceptable for export, assuming that export will not affect the internal sales.

Problem 6.34 (*Discontinuance of a Product*)

An industrial concern which had no costing system appointed a Cost Accountant. After installing a system of collection of cost data, the Cost Accountant observed that out of the three products which are produced independent of each other, loss is being incurred in product *B*. He immediately decides to advise management to discontinue manufacture of this product supported by the following tabulation:

	Product A ₹	*Product B* ₹	*Product C* ₹
Sales	1,00,000	65,000	4,90,000
Variable manufacturing cost	52,000	26,000	1,40,000
Fixed manufacturing overhead (apportioned)	6,500	19,000	1,05,000
Variable selling and distribution cost	18,000	17,000	18,000
Fixed selling and distribution costs	4,600	4,600	4,000
Total cost	81,000	66,600	2,67,000
Net profit	18,900	—	2,23,000
Net loss	—	1,600	—

Do you agree with the Cost Accountant's conclusion? Argue with your views on the basis of data.

(I.C.W.A. Inter)

Solution

Profitability Statement

	Product A ₹	Product B ₹	Product C ₹
Sales	1,00,000	65,000	4,90,000
Variable cost:			
Manufacturing	52,000	26,000	1,40,000
Selling and distribution	18,000	17,000	18,000
Marginal cost	70,000	43,000	1,58,000
Contribution	30,000	22,000	3,32,000
Fixed cost			
Manufacturing	6,500	19,000	1,05,000
Selling and distribution	4,600	4,600	4,000
Total fixed cost	11,100	23,600	1,09,000
Profit/Loss	18,900	(-)1,600	2,23,000
(i) P/V ratio	30%	34%	67.8%
(ii) Ratio of fixed cost to variable cost:			
(a) Manufacturing	12.5%	73.1%	75%
(b) Selling and distribution	25.5%	27.1%	22%
(iii) Total selling and distribution cost as a ratio of sales	22.6%	33.2%	4.5%

Conclusion. Product *B* should not be discontinued because :

(*i*) Product *B* appears unprofitable because of arbitrary apportionment of fixed overhead. It is burdened with 73.1% fixed manufacturing overhead of its variable cost which is almost six times that of product *A*.

(*ii*) Product *B* is no less profitable than product *A* as P/V ratio of *B* is 34% which is more than of *A*.

(*iii*) Although sales of *B* are much less than *A* and *C*, it is burdened with the same amount of selling and distribution costs.

(*iv*) By discontinuing product *B*, the contribution of ₹ 22,000 made by it will not be available, hence the loss would be equal to the amount of fixed cost of ₹ 23,600 apportioned to it.

Problem 6.35 (*Differential Cost Analysis*)

The following extracts are taken from sales budget of a company for a current year:

		Rupees in '000
Sales : 40,000 units @ ₹ 25 per unit		1,000
Selling costs:		
Advertising	100	
Salesmen's salaries	80	
Travelling expenses	50	
Rent of sales office	10	
Others	10	250

The management is considering a proposal to establish a new market in the eastern region in the next year. It is proposed to increase the advertising expenditure by 25% and appoint an additional sales supervisor at a salary of ₹ 30,000 per year to establish a market. This will involve additional travelling and travelling expense shall increase by 10%.

Target annual sales volume at the existing selling price for the new market is 10,000 units. The estimated variable cost of production is ₹ 12 per unit.

Should the company try to establish the new market? *(I.C.W.A. Inter)*

Solution

Statement of Incremental Cost and Revenue

	Present position	*Proposed position*	*Incremental cost and revenue*
Sales units	40,000	50,000	10,000
(A) Sales ₹ '000	1,000	1,250	250
Costs: Advertising	100	125	25
Sales salaries	80	110	30
Travelling exp.	50	55	5
Rent	10	10	—
Others	10	10	
	250	310	60
Variable costs of production @ ₹ 12 per unit	480	600	120
(B) Total cost	730	910	180
Profit (A–B)	270	340	70

Conclusion. There is incremental cost of ₹ 1,80,000 against incremental revenue of ₹ 2,50,000 resulting in net additional income of ₹ 70,000 (*i.e.*, ₹ 2,50,000 – 1,80,000). Therefore the proposal should be accepted.

Problem 6.36 (*Differential Cost Analysis*)

A company has an installed production capacity of 1,00,000 units and presently it is working at 70% capacity utilization. As production capacity utilization increases, cost per unit decreases as follows :

Capacity utilization	*Cost per unit*
70%	₹ 97
80%	₹ 92
90%	₹ 87
100%	₹ 82

The company has received three export orders from different sources as under:

Source *A* - 5,000 units at ₹ 55 per unit
Source *B* - 10,000units at ₹ 52 per unit
Source *C* - 10,000units at ₹ 51 per unit

Advise the company whether any or all the export orders should be accepted or not.

(B.Com. Hons., Delhi)

Solution

Statement of Differential Cost (D.C.)

Capacity %	Production units	Cost per unit ₹	Total Cost ₹	D.C. Total ₹	D.C. per unit ₹
70	70,000	97	67,90,000	–	–
80	80,000	92	73,60,000	5,70,000	57
90	90,000	87	78,30,000	4,70,000	47
100	1,00,000	82	82,00,000	3,70,000	37

Gain/Loss on Accepting Various Export Orders

Source	Order size	Capacity	DC. P.U. ₹	DC. Total ₹	Price P.U.	Sales ₹	Profit/loss ₹
A	5,000	75%	57	2,85,000	55	2,75,000	(–)10,000
B	10,000	85%	5,000@57 5,000@47	5,20,000	52	5,20,000	Nil
C	10,000	95%	5,000@47 5,000@37	4,20,000	51	5,10,000	+80,000
Total	25000						

Conclusion. Acceptance of orders only from source A or A and B gives a loss of ₹ 10,000. But when all the three orders are accepted, the company makes a profit of ₹ 80,000. Thus the company should accept all the orders.

Problem 6.37 (*Differential Cost Analysis*)

X Ltd. has been offered an order from *A* Ltd. for 10,000 units of output @ ₹ 100 each, which has a variable cost of ₹ 60 and will involve an outlay of ₹ 60,000 for set up, jigs and dies. At the same time there is another offer of an order from B Ltd. for 8,000 units of output at ₹ 110 each. Variable costs are estimated at ₹ 68 each and involve and outlay of ₹ 50,000 for set up, jigs and dies. Which order should the Company accept?

Solution

Statement of Incremental Revenue and Cost

	A Ltd.	B Ltd.
(*a*) Size of order (units)	10,000	8,000
	₹	₹
(*b*) Price per unit	100	110
(*c*) Variable cost per unit	60	68
(*d*) Incremental revenue (*a*) × (*b*)	10,00,000	8,80,000
(*e*) Incremental variable cost (*a*) × (*c*)	6,00,000	5,44,000
(*f*) Contribution (*d*) – (*e*)	4,00,000	3,36,000
(*g*) Outlay for set up, jigs etc.	60,000	50,000
(*h*) Total incremental cost (*e*) + (*g*)	6,60,000	5,94,000
(*i*) Net incremental revenue (*d*) – (*h*)	3,40,000	2,86,000
(*j*) P/V ratio [(*f*) ÷ (*d*)] × 100	40%	38%

Conclusion. It may be concluded form the above analysis that order from *A* Ltd is more profitable because it gives a higher incremental revenue of ₹ 54,000 (₹ 3,40,000–2,86,000). Order from *A* Ltd. should, therefore, be accepted. P/V ratio from *A* Ltd. is also higher.

KEY TERMS

Decision-making It is the basic functions of management which involves selecting the best course of action from two or more available alternatives.

Relevant Costs These are the future costs which differ among alternative courses of action and which are used in making decisions.

Irrelevant Costs These are the costs which were incurred in the past and also which do not change between alternatives. These costs are not considered relevant in making decisions.

Selling Prices Decisions In the long run, under normal circumstances, the management should ensure that the selling price must cover total cost and also give a reasonable amount of profit. But sometimes due special market conditions, such as depression, competition, exporting etc., the management may have to sell its product at a special price which may be lower than the total cost. But this should be done on a short term basis only.

Make or Buy Decisions In such decisions, outside supplier's price should be compared with firm's own variable cost. It is profitable to buy from outside if supplier's price is below firm's own variable cost of manufacture, considering non-cost factors.

Product Mix Decisions A mix that provides the highest amount of contribution is considered as the most profitable mix.

Selection of a Suitable Method of Production, the management should select the method which gives the largest contribution (*i.e.*, the lowest marginal cost), keeping in view the limiting factor.

Differential cost is the difference in the cost of two alternatives.

Differential cost analysis is a technique to help in decision-making. Here decisions are based on comparison of differential cost and incremental revenue.

Incremental Revenue It is an increase in revenue due to change in alternative course of action.

EXAMINATION QUESTIONS

Objective Type Questions

True or False?

1. Depreciation of plant is an example of imputed cost.
2. In differential cost analysis, managerial decisions are based on P/V ratio and contribution.
3. Out of pocket costs are not relevant for decision-making.
4. Cost per unit of key factor is the basis of ranking products on profitability.
5. Future costs and not the past costs are relevant for managerial decisions.
6. Export orders should not normally be accepted at a price below total cost.
7. Wages of workmen is an out of pocket cost.
8. Differential cost analysis helps in make or by decisions.
9. Management may sell at a price which is even below marginal cost in certain special circumstances.
10. Differential cost is also known as incremental cost.
11. Conversion cost is the total of direct labour and factory overhead.
12. In make or buy decision, it is profitable to buy from outside firm when supplier's price is below firm's own total cost.

[**Ans.** 1. False; 2. False; 3. False; 4. False; 5. True; 6. False; 7. True; 8. True; 9. True; 10. True; 11. True; 12. False]

Essay Type Questions

1. Explain fully the concept of 'relevant cost' in managerial decision-making. *(B.Com. Hons., Delhi)*
2. Explain the technique of marginal costing and state its importance in decision making. *(M.Com., Bangalore)*
3. "The technique of marginal costing is more used to provide a reasonable and sound basis for managerial decisions than to arrive at product cost" Explain. *(C.S. Inter)*
4. "The technique of marginal costing can be a valuable aid to management". Discuss. *(B.Com. Hons., Delhi)*
5. What do you mean by make or buy decisions ? State the quantitative as well as qualitative considerations influencing a 'make or buy' decision. *(B.Com. Hons. Delhi)*
6. Explain briefly the circumstances under which selling below marginal cost may be justified. *(B.Com. Hons. Delhi)*
7. Do you thinks a producer can sell his output even below variable cost ? If so, mention these circumstances. *(B.Com. Hons. Delhi)*
8. There is a general recession in the country which is considered to be of a temporary nature and the company in which you are employed as a cost accountant does not want to retrench personnel. An order is available for a product at a selling price which evidently is below the cost of production. What advice will you give to the management regarding this and why ? *(B.Com. Hons. Delhi)*
9. Mention five areas of business activity that frequently require managerial decision as to policy. How cost analysis is helpful in decision-making in these areas? *(B.Com., Calcutta)*
10. Indicate any five circumstances under which you will allow to fix a price which is less than the marginal cost. *(C.S. Inter)*
11. Discuss the role of contribution in marginal costing and its relevance to decisions relating to fixation of selling prices. Enumerate the circumstances which might justify the fixation of selling prices equal to or below marginal cost. *(I.C.W.A. Inter)*
12. State the costing data required for (*i*) determining the priority of various products, and (*ii*) make or buy decisions. *(B.Com. Hons. Delhi)*
13. What are the specific cost and non-cost factors that are considered before a 'make or buy' decision is taken? *(C.S. Inter)*
14. What is differential costing ? Explain its importance in decision making. *(B.Com. Hons. Delhi)*
15. What is meant by Differential Cost Analysis? Explain the essential features and points of similarity and difference between Differential Cost Analysis and Marginal Costing. *(M.Com. Calcutta)*
16. What do you understand by Differential Cost Analysis? Explain (*a*) the essential features of differential costing, and (*b*) its practical applications. *(B.Com. Andhra)*
17. Distinguish between marginal costing and differential costing. *(B.Com. Hons. Delhi)*

Practical Questions

1. A company producing 24,000 units provides you the following information:

	₹
Direct material	1,20,000
Direct wages	84,000
Variable overheads	48,000
Semi-variable overheads	28,000
Fixed overheads	80,000
Total cost	3,60,000

The product is sold at ₹ 20 per unit.

The management proposes to increase the production by 3,000 units for sales in the foreign market. It is estimated that the semi-variable overheads will increase by ₹ 1,000. But the product will be sold at ₹ 14 per unit in the foreign market. However, no additional capital expenditure will be incurred. The management seeks your advice as a cost accountant. What will you advise them?

(B.Com. Hons., Delhi)

[**Ans.** Proposal for sale in the foreign market should be accepted because it will give additional profit of ₹ 9,500]

2. Lovely Snow Company manufactures and sells direct to consumers 10,000 jars of Lovely Snow per month at ₹ 5 per jar. The company's normal production capacity is 20,000 jars of snow per month. An analysis of cost of 10,000 jars shows:

	₹
Direct materials	4,000
Direct labour	9,900
Power	560
Miscellaneous Expenses	1,720
Jars	2,400
Fixed Expenses	31,820
	50,400

The company has received an offer for the export under a different brand name of 1,20,000 additional jars of snow at 10,000 jars per month at ₹ 3 per jar.

Write a note showing your calculations, on the advisability or otherwise of accepting the offer.

(M.Com., Madras)

[**Ans.** Offer for export should be accepted as the offer price is above variable cost]

3. A manufacture of a certain product has been selling exclusively in the Indian market up to now. He has just received his first export enquiry and wants to quote as competitively as the circumstances will allow. His latest Indian cost sheet is :

Raw materials	₹ 34 per unit
Direct labour	13
Services	6
Works overhead	7
Office overhead	2
	62
Profit earned in India	6
Indian selling price	68

Management is thinking of quoting a selling price somewhere between ₹ 62 and ₹ 68 per unit for this export order. One of the directors suggests quoting an even lower price based on the principles of marginal costing. As the firm's accountant, you are requested to compute the lowest price the management could quote on these principles. State clearly any assumptions that you may make on the above facts and also on any other costs or facts. *(C.A. Inter)*

[**Ans.** Variable cost ₹ 51 per unit. A price above this is acceptable]

(Assumptions. Works overhead and office overhead have been assumed to be fixed. Services are assumed to be ₹ 2 fixed and ₹ 4 variable. There is sufficient spare capacity.)

4. A toy manufacturing company presents the following information for the year 2017.

	₹
Material cost	1,20,000
Labour cost	2,40,000
Fixed overhead	1,20,000

Variable overhead	60,000
Selling price per unit	50
Units produced — 12,000	

The available capacity is a production of 20,000 units per year. The firm has an offer for the purchase of 5,000 additional unit at a price ₹ 40 per unit. It is expected that by accepting this offer there will be a saving of ₹ 1 per unit in material cost on all units produced, the fixed overhead will increase by ₹ 35,000 and the overall efficiency will drop by 2% on all production. Should this offer be accepted? *(I.C.W.A. Inter)*

[Ans. Offer should be accepted. Profit will increase from ₹ 60,000 to ₹ 60,200]

5. XYZ Co. manufactures lathes of Captain brand and sells them at ₹ 36,500 each made up as follows:

	₹
Direct materials	16,000
Direct labour	2,000
Factory variable overhead	5,000
Fixed overhead	3,000
Depreciation	2,000
Selling variable overheads	500
Royalty	1,000
Profit	2,000
Total	31,500
Central excise duty	2,000
Sales tax	3,000
Selling price	36,500

There is enough idle capacity.

(*a*) A firm in Africa has offered to buy 10 lathes at ₹ 28,500 each. Should the company be interested in the business?

(*b*) It has also decided to sell five such lathes to an engineering company under the same management at bare cost. What price should be charged. *(I.C.W.A. Inter)*

[Ans. (*a*) Offer should be accepted presuming sales tax and excise duty are exempted. (*b*) ₹ 29,500, *i.e.*, marginal cost + excise duty + sales tax]

6. An enthusiastic marketing manager suggests to his managing director that if he is permitted to reduce the selling price of a product by 20%, he would be able to achieve a 30% increase in sales volume. The managing director, finding that the sales volume increases exceeds in percentage the extent of requested reduction in price, gives the clearance. You are given the following information:

Present selling price per unit	₹ 7.50
Present volume of sales	2,00,000 units
Total variable costs	₹ 10,50,000
Total fixed costs	₹ 3;60,000

Assuming no changes in the costs pattern in the coming period.

(*a*) Examine the consequences of the managing director's decision assuming that 30% increase in sales is realised.

(*b*) At what volume of sales can the present quantum of profits be sustained, after effecting the price reduction. *(C.A. Inter)*

[Ans. (*a*) Additional loss of ₹ 2,55,000, (*b*) At 6,00,000 units, the present profit of ₹ 90,000 can be sustained]

(Hint. Use differential cost analysis).

7. Samson & Co. annually manufactures 10,000 units of a product at a cost of ₹ 4 per unit. There is home market for consuming the entire volume of production at the sale price of ₹ 4.25 per unit.

In the next year, there is a fall in the demand for home market which can consume 10,000 units only at a sale price of ₹ 3.72 per unit. The analysis of the cost per 10,000 units is :

Material	₹ 15,000
Fixed overheads	8,000
Wages	11,000
Variable overheads	6,000

The foreign market is explored and it is found that this market can consume 20,000 units of the product if offered at a sale of ₹ 3.55 per unit. It is also discovered that for additional 10,000 units of the product (over initial 10,000 units) the fixed overheads will increase by 10%. Is it worthwhile to try to capture the foreign market? (*C.S. Inter*)

[**Ans.** Order should be accepted because it will add ₹ 5,400 to profit. Total variable cost ₹ 64,000; Additional fixed cost ₹ 1,600]

8. *X* Ltd. markets a single product and provides you the following data:

	Per unit ₹
Materials	16
Conversion costs (variable)	12
Dealer's margin	4
Selling price	40

Fixed cost : ₹ 5 lakhs
Present sales : 90,000 units
Capacity utilisation : 60 percent

There is acute competition. Extra efforts are necessary to sell. Suggestions have been made for increasing sales:

(*a*) By reducing sales price by 5 percent.

(*b*) By increasing dealer's margin by 25 per cent over the existing rate.

Which of these two suggestions you would recommend, if the company desires to maintain the present profit? Given reasons. (*C.S. Inter*)

[**Ans.** Contribution per unit (*a*) 6.20 (*b*) ₹ 7. Present profit ₹ 2,20,000; Suggestion (*b*) is recommended, sale 1,02,857 units]

(**Hint :** It is assumed that dealer's margin is 10% of selling price. Alternative (*a*) New selling price ₹ 38. Dealer's margin ₹ 3.80).

9. *AB* Company uses three different components (materials) in manufacturing its primary product. It manufactures two of the components and purchases one (designated as Component I) from outside supplies. The company is currently developing the annual profit plan. Sales are highly seasonal. Component 2 cannot be acquired from outsiders; however, Component 3 can be purchased. The three Components have critical specifications. The annual profit plan provided data for the following computations:

	Component 3 unit cost (At 12,000 units) ₹
Material (direct)	1.40
Labour (direct)	2.20
Fixed overhead (apportioned)	0.40
Annual machine rental (Special machine used only for component 3)	0.50
Variable factory overhead	1.00
Average storage cost per year (fixed)	0.40
Total	5.90

Average inventory level is 500 units.

The purchase manager investigated outside suppliers and found one that would sign an year contract to deliver "12,000 top quality units as needed during the year at ₹ 5.20 per unit." Serious consideration is being given to this alternative. Should the Company make or buy Component 3? Explain the relevant factors influencing your decision. *(I.C.W.A. Inter)*

[Ans. It is advisable to make the Component. Variable cost is ₹ 5.10 whereas supplier's price is ₹ 5.20]

10. XYZ Co. produces product P in its workshop *'A'*. The overhead recovery rate is 100% of direct wages based on the following budgeted figures:

	₹
Direct wages	1,60,000
Variable overhead	64,000
Fixed overhead	96,000

The production plan for the same budget period envisages an output of 18,000 units of product *'P'* whose cost and sales data are as under:

	₹ *per unit*
Selling price	42
Direct materials	12
Direct wages	8
Total overheads	8

The company proposes to use the balance capacity of workshop *'A'* after completing the above said production plan for the manufacture of component *'Q'* whose cost data are as under:

	₹ *per unit*
Direct materials	8
Direct wages	16
Total overheads	16

The component *Q* is used by the company in the manufacture of some other product in another production department.

The company receives an export order from abroad for the purchase of 2,000 units of product *P* at ₹ 30 each. This offer can be accepted by diverting the capacity from component *Q*. In that event the company has to buy the component which is available from an outside supplier at a price of ₹ 40 each.

You are required to evaluate the alternative courses of action and state with reasons whether the spare capacity should be utilised for the manufacture of:

(*a*) The component *Q*, or

(*b*) 2,000 units of product *P* for export and buying of the component *Q* from the outside supplier. *(I.C.W.A. Inter)*

[Ans. It is more profitable to accept the export order and purchase the component Q from outside as it will increase the contribution by ₹ 4,000]

(Hint : Variable overhead are 40% of direct wages. Marginal cost of *'P'* is ₹ 23.20 per unit and of *'Q'* is ₹ 30.40 per unit. Spare capacity available in terms of labour cost ₹ 16,000. This can produce 1,000 units of *'Q'* or 2,000 units of *'P'*).

11. A review made by the top management of Sweat and Struggle Ltd. which makes only one product of the result of the first quarter of the year revealed the following :

Sales in units		10,000
Loss	₹	10,000
Fixed cost (For the year ₹ 1,20,000)	₹	30,000
Variable cost per unit	₹	8

(*i*) The Finance Manager, who feels perturbed, suggests that the company should at least break-even in the second quarter with a drive for increased sales. Towards this, the company should introduce a better packing which will increase the cost by ₹ 0.50 per unit.

(*ii*) The Sales Manager has an alternate proposal. For the second quarter additional sales promotion expenses can be increased to the extent of ₹ 5,000 and profit of ₹ 5,000 can be aimed at in the period with increased sales.

(*iii*) The Production Manager feels otherwise. To improve the demand, the selling price per unit has to be reduced by 3%. As a result, the sales volume can be increased to attain a profit level of ₹ 4,000 for the quarter.

The Managing Director asks you, as a Cost Accountant, to evaluate these three proposals and calculate the additional sales volume that would be required in each ease, in order to help him take a decision. *(I.C.W.A. Inter; C.A. Inter)*

[**Ans.** (*i*) Additional 10,000 units to break-even (*ii*) Additional 10,000 units earn a profit of ₹ 5,000 (*iii*) Additional 10,000 units earn a profit of ₹ 4,000]

12. Calculate the effect of change in the sales mix from the following data:

	Products				
	A	*B*	*C*	*D*	*Total*
Sales (₹)	40,000	50,000	20,000	10,000	1,20,000
Variable cost (₹)	24,000	34,000	16,000	4,000	78,000
Fixed cost (₹)	—	—	—	—	29,400
Sales mix changed to	30,000	44,000	40,000	6,000	1,20,000

(I.C.W.A. Inter)

[**Ans.** The new sales mix will reduce profit by ₹ 4,320]

13. Given the following information, you are required to :

(*a*) Calculate the marginal product cost and contribution per unit.

(*b*) State which of the alternative sales mixes you would recommend to management and why.

	Per unit	*Per unit*
	X	*Y*
Selling price	₹ 25	₹ 20
Direct materials	₹ 8	₹ 6
Direct wages	24 hours at 25 paise per hour.	16 hours at 25 paise per hour

Fixed overhead – ₹ 750

Variable overhead – 150% of direct wages

Alternative sales mix:

(*i*) 250 units of *X* and 250 units of *Y*

(*ii*) Nil units of *X* and 400 units of *Y*

(*iii*) 400 units of *X* and 100 units of *Y*

(I.C.W.A., Inter).

[**Ans.** Sales mix, (*ii*) is the most profitable]

14. A manufacture with an overall (inter-changeable among the products) capacity of one lakh machine hours has been so far producing a standard mix of 15,000 units of product A and 10,000 units of products *B* and *C* each. The total expenditure exclusive of fixed charges is found to be ₹ 2.09 lakhs and the cost ratio among the products approximates 1 : 1.5 : 1.75 respectively per unit. Fixed charges come to ₹ 2 per unit. When the unit selling prices are ₹ 6.25 for *A*, ₹ 7.50 for *B* and ₹ 10.50 for *C*, he incurs a loss. He desires to change the sales mix as under:

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	Mix I	Mix II	Mix III
A	18,000	15,000	22,000
B	12,000	6,000	8,000
C	7,000	13,000	8,000

As a Cost Accountant which mix do you recommend?

(**Ans.** Sales Mix III is recommended as it shows a profit of ₹ 300. Sales Mix I shows a loss of ₹ 6,300 and sales Mix II shows a loss of ₹ 450)

16. Ambica Condiments bring out two products 'Suchi' and 'Ruchi' which are popular in market. The management has the option to alter the sales mix of the two products from out of the following combinations:

	Suchi (units)	Ruchi (units)
Option I	800	600
II	1,600	—
III	—	1,300
IV	1,100	500
Per unit data are		
Direct materials (₹)	25	30
Direct labour (hrs.)	10	12
Variable overhead (factory) is 100% of direct labour cost for the both products.		
Selling price (₹)	75	90

Labour rate is ₹ 2 per hour.

Common fixed overhead for both products ₹ 10,000

You are required to

(*i*) Prepare a marginal cost statement for the two products; and

(*ii*) Evaluate the options and identify the most profitable sales mix. (*I.C.W.A., Inter*)

[**Ans.** Contribution per unit–Suchi ₹ 10, Ruchi ₹ 12. Option IV is the most profitable sales mix. It gives a profit of ₹ 7,000]

16. The cost per unit of the three products *A*, *B* and *C* of a concern are as follows:

	A ₹	*B* ₹	*C* ₹
Variable cost	20	20	18
Fixed cost	3	3	2
Total cost	23	23	20
Profit	9	7	6
Selling price	32	30	26
Number of units produced	10,000	5,000	8,000

Production arrangements are such that if one product is given up, the production of the others can be raised by 50%. The directors propose that C should be given up because the contribution in that case is the lowest. Do you agree? What other non-cost considerations should be kept in mind before taking a decision in such a situation? (*B.Com. Hons., Delhi*)

[**Ans.** Profit is highest at ₹ 2,15,000 when product *B* is given up and production of *A* and *C* is incrcased by 50%, Total fixed cost is ₹ 61,000]

17. A company has a plant capacity of 19,800 machine hours. The plant can produce either product A or product B or a mixture of the two products. The following relevant information is given

	Product A	Product B
Selling price per unit	₹ 45	₹ 30
Variable cost per unit	₹ 30	₹ 18
Machine hours per unit	5	3

Market conditions are such that not more than 5,000 units of A and 4000 units of B can be sold in a year. Fixed cost are ₹ 60,000.

Compute the product mix that will maximise the net income and find that maximum income. *(Adapted)*

[**Ans.** Ranking B, A, Mix — 4,000 units of B and 1,560 units of A;. Maximum net income ₹ 18,720]

18. *ABC* Ltd is at present operating at 80% capacity level, the production being 15,000 units per annum. It operates a flexible budgetary control system. The following relevant cost data are obtained from the company's budget at different capacity utilisation levels:

	Capacity utilisation level	
	80%	100%
Sales	₹ 20,00,000	25,00,000
Variable overheads	₹ 2,25,000	2,50,000
Semi-variable overhead	₹ 1,05,000	1,11,000
Fixed overheads	₹ 4,00,000	4,70,000
Output (in units)	15,000	18,750

Material and labour cost per unit are constant under the present conditions. The management expects a profit margin of 10% on sales.

You are required to compute the differential cost of producing the additional 3,750 units by increasing the capacity utilisation level to 100 per cent. *(B.Com. Hons., Delhi)*

[**Ans.** Differential cost ₹ 3,68,500]

19. In a factory the rated capacity is 30,000 units. The following data is supplied:

	Output upto-15000 units	*From 15001–25000 units*	*From 25001–30000 units*
	₹	₹	₹
Fixed cost	15,000	16,000	19,500
Variable cost per unit	3	3	3.25
Sales revenue per unit	4	3.80	3.80

What is the most profitable level of output? Use differential cost analysis. *(Adapted)*

[**Ans.** 25,000 units]

20. A company has a capacity of producing 50,000 units of a certain product in a month. The sales department reports that the following schedule of selling prices is possible:

Volume of sales (*% capacity*)	Unit selling price ₹
50%	2.00
60%	1.90
70%	1.85

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80%	1.80
90%	1.70
100%	1.60

The variable cost of manufacture between the above levels is ₹ 1 per unit and the total amount of fixed cost is ₹ 20,000 p.m. at 100% capacity level.

Prepare a statement showing incremental revenue and differential cost at each of the above levels of production and sales. At which level the profit will be maximum? *(B.Com. Hons., Delhi)*

[Ans. 80%**]**

21. Sewing Machines Co. manufactures hand-operated sewing machines. Prepare a schedule showing the total differential costs and increments in revenue from the following data. At what volume the company should set its level of production?

Output (Nos. in Lakhs)	*Selling price per machine (₹)*	*Total semi-fixed cost (₹ in lakhs)*	*Total variable cost (₹ in lakhs)*	*Total fixed cost (₹ in lakhs)*
0.60	240	30	83.5	28.40
1.20	220	30	163.6	28.40
1.80	200	34	255.6	28.40
2.40	180	34	315.6	28.40
3.00	160	40	355.6	28.40
3.60	140	40	380.4	28.40

(I.C.W.A.)

[Ans. 3 lakh units**]**

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CHAPTER 7

RESPONSIBILITY ACCOUNTING AND DIVISIONAL PERFORMANCE

CHAPTER OUTLINE

Introduction ; Meaning and definition ; Pre-requisites ; Responsibility centre and its types ; Features ; Advantages ; Measurements of divisional performance; Return on investment (ROI) ; Residual income (RI) ; Problems and solutions ; Key terms; Examination questions.

Introduction

Responsibility accounting is one of the basic components of a good control system. The main characteristic feature of this control system is that it is relevant to measurement of performance of divisions of an organisation while other control systems are applicable to the organisation as a whole. Budgeting and variance analysis (standard costing) are thus part of the responsibility accounting process.

Responsibility accounting has close link with the size of an organisation. It has no scope in a small organisation because in such a business all decision making is centralised at one place and one individual. As companies grow in size, they tend to decentralise because decentralisation for large and diversified companies is necessary for better management. In big and diversified companies like Hindustan Uniliver Ltd. and ITC Ltd., which produce and sell a wide variety products/services, responsibility accounting proves extremely useful. Because of the complexity of operations in such companies, it is very difficult for the head office to directly control the operations of all divisions of business. It is, therefore, appropriate to divide the company into separate self contained divisions and to allow all divisional managers to operate with a great deal of independence. Take the case of ITC Ltd, which is in the business of cigarette, hotels, packaged food, branded apparel, FMCG, and information technology, etc. In applying responsibility accounting to such a business model, each hotel manager may be asked to run the hotel as an independent unit like a small business. Each hotel will then be treated as a responsibility centre. Similarly, cigarette business may be decentralised and made a responsibility centre. In this way, a number of responsibility centres will be created for each line of business which should promote the long term interest of the larger organisation and coordinate their activities with other responsibility centres of the company.

Meaning and Definition

Responsibility accounting is a method of accumulating and reporting both budgeted and actual costs and revenues by divisional managers responsible for them. It means in responsibility accounting, costs are identified with persons rather than products or functions and responsibility is assigned to the manager best placed to effect control. The idea of responsibility accounting is that managers will be held responsible only for those items over which they can exercise a significant amount of control. A manager should also not claim credit for those revenues which is not the result of his action and performance.

Horngren has defined responsibility accounting as *"a system of accounting that recognises various responsibility centres throughout the organisation and reflects the plans and actions of each of these centres by assigning particular revenues and costs to the one having the pertinent responsibility."*

Responsibility accounting thus refers to an accounting system that reports how well each manager has fulfilled the responsibility assigned to him.

Pre-requisites for Responsibility Accounting

Responsibility accounting is based on certain assumption. These pre-requisites/assumptions are as follows :

1. It should be a big company with a divisionalised organisational structure and where areas of responsibility are well defined at different levels of the organisation.
2. There are clearly set goals and targets for each responsibility centre.
3. Managers actively participate in establishing the budgets against which their performance is measured.
4. Accounting system generates correct and dependable information for each responsibility centre.
5. The managers are held responsible only for those activities over which they exercise significant degree of control.
6. Managers must try to attain the goals and objectives.
7. Goals for each area of responsibility should be attainable with efficient performance.
8. Performance reporting should be timely and should contain significant information relating to the responsibility centre.

RESPONSIBILITY CENTRE

The basic idea of responsibility accounting is that large diversified organisations are difficult, if not impossible, to manage as a single segment. Thus they must be decentralised or separated into smaller manageable parts. The parts or segments are referred to as responsibility centres.

A responsibility centre *"is a division of the organisation for which a manager is held responsible"* CIMA, London has defined responsibility centre as *"a segment of the organisation, where an individual manager is held responsible for its segment's performance."*

In the words of Horngren, *"a responsibility centre is a part, segment or sub-unit of an organisation whose manager is accountable for a specified set of activities."* Example of a responsibility centre in a company running a chain of hotels may be one hotel whose manager will be accountable for its performance. A responsibility centre is like a small business to achieve the objectives of a large organisation. For an organisation to be successful, the activities of its

responsibility centres must be coordinated. An important criterion for creating responsibility centre is that the unit of organisation should be seperate and identifiable for the purpose of its performance evaluation. It should also be understood that for creating responsibility centre, it is not necessary that organisation must be decentralised because responsibility centres can be found in both centralised and decentralised organisations.

Types of Responsibility Centre

Responsibility centres are of four types — cost centre, revenue centre, profit centre and investment centre. Together they form the basis of responsibility accounting.

(*a*) **Cost centre.** It is defined by C.I.M.A., London as *"a production or service location, function, activity or item of equipment whose costs may be attributed to cost units."* A responsibility centre is a cost centre where the manager is accountable for the costs that are under his control but not for its revenues. Only those costs are charged to cost centre which are controllable by the manager of the cost centre. For example, the maintenance department of a hotel may be a cost centre because the maintenance manager is responsibility only for the costs.

(*b*) **Revenue Centre.** A responsibility centre is a revenue centre in which manager controls revenues but does not control either the costs of products/services or the level of investment made in the responsibility centre. Revenue centre may control selling prices, product mix and promotional activities to enhance revenues. The sales department of a hotel will be a revenue centre because it is responsible only for revenues.

(*c*) **Profit centre** According to C.I.M.A., London, a profit centre is *"a part of a business accountable for costs and revenues. It may be called a business centre, business unit, or strategic business unit."* Thus a responsibility centre is a profit centre where the manager is accountable for sales revenue as well as costs. The difference between revenues and costs is profit. For example, a unit of a company is a profit centre if it is responsible for sales as well as production in that unit.

The hotel manager would be in charge of a profit centre because he is responsible for revenue and costs. A profit centre is like an independent business except that the senior management in the head office control the level of investment in the responsibility centre. Most individual units of chain operations, whether they are restaurants, hotels, motels or stores are treated as profit centres.

Manager of a profit centre aims at maximising profit by making decisions relating to production volume, product mix, production technology, selling price, marketing strategy, discount and credit policies, etc.

(*d*) **Investment centre.** It is defined by C.I.M.A., London as *"a profit centre whose performance is measured by its return on capital employed."* Thus a responsibility centre is an investment centre where is manager is responsible for sales revenues and costs and in addition is responsible for some capital investment decision relating to working capital management, capital structure and capitalisation, etc. His performance is measured in terms of profit as related to capital base.

Investment centre is also like an independent business where even investment decisions are made by the manager of the division. A new hotel being developed by a company would be an investment centre if the manger is responsible for investments in the hotel project and also for its costs and revenues. Difference between investment centre and profit centre is that an investment centre adds responsibility for investments to profit centre responsibilities.

The objective of responsibility accounting is to accumulate costs and revenues for each

responsibility centre so that variances from budgets are attributed to the manager concerned. Responsibility accounting is implemented by issuing performance reports at frequent intervals that inform the manager of the responsibility centre regarding the variances between his actual and budgeted results.

Features of responsibility accounting

The basic method of control in responsibility accounting is the same as used in budgetary control and standard costing and may be stated in the following points:

1. Responsibility centres are created.
2. A plan is prepared in the form of budgets or standards for each responsibility centre.
3. The performance of the responsibility centre is evaluated by comparing actual results with those budgeted in the regular monthly reports.
4. Variances between actual and budgeted performance are analysed so as to fix responsibility.
5. Corrective and preventive action is taken, wherever possible.

Advantages

The following advantages accrue from a system of responsibility accounting :

1. Responsibility for any adverse performance is clearly identified. As a result, the individual managers may find it difficult to shift the responsibility to any other manager.
2. The morale of the managers is high because of their active participation in decision making.
3. Responsibility accounting provides increased job satisfaction and greater motivation to put in their best efforts.
4. It helps in quick reporting of performance oriented results of management of various levels.
5. Managers of responsibility centres get an opportunity to gain valuable managerial skill.
6. Responsibility accounting facilitates stricter control on costs and revenues.

Responsibility accounting is often focussed on the lowest level managers who have the most day-to-day influence on costs, where a person can significantly influence the amount of cost through his own action. A major problem in responsibility accounting is establishing controllability. In the strict sense, a particular item of cost is controllable when it can be definitely influenced by a given manager within a given time span. But the problem is that hardly any costs are clearly under the sole influence of only one person. Take the case of material costs. Material prices are influenced by the purchase manager while material quantities consumed are influenced by the production manager.

Responsibility accounting can never be a substitute of good management. It is simply a tool of management. Some systems that are otherwise sound never get off the ground because the managers do not really understand them nor put them to good use. Nor responsibility accounting is an accounting technique that stands or falls on the accountant's use of it. It is an integral part of the management process and the accountant's role is a technical and supporting one. Unless the operating managers enthusiastically support responsibility accounting and make it to work, even the best conceived system will fail.

DIVISIONAL PERFORMANCE

It has been stated earlier that in large companies, particularly those which produce and sell a wide variety of products, it is appropriate to divide the company into separate divisions and

all the divisional managers to operate with a great deal of independence. By creating various divisions, a decentralised organisation structure will be created and each division will be a responsibility centre. Where divisional manager has authority and responsibility for making capital investment decisions, the division will be a an investment centre. But where the manager is responsible only for costs and revenues obtained from operations, the division will be a profit centre. In responsibility accounting, the profitability of each responsibility centre is measured. In Fig. 7.1 a divisionalised organisation structure is shown, where the company is manufacturing and selling a number of products. For each product a division has been created under the charge of a divisional manger. Each division is a responsibility centre of which performance will be seperately measured and compared with other responsibility centres for managerial decisions.

A functional organisation structure has been shown for each division with seperate departments for production, purchase, marketing and finance, etc. These departmental managers will be responsible for activities under their respective functions such a purchase, production, etc. It may not be practicable to divisionalise the entire company. These may be certain common functions such as industrial relations, research and development, etc. which will be under the central administration of the corporate head quarters. The chief executive will have the responsibility of providing these central services to all the divisions.

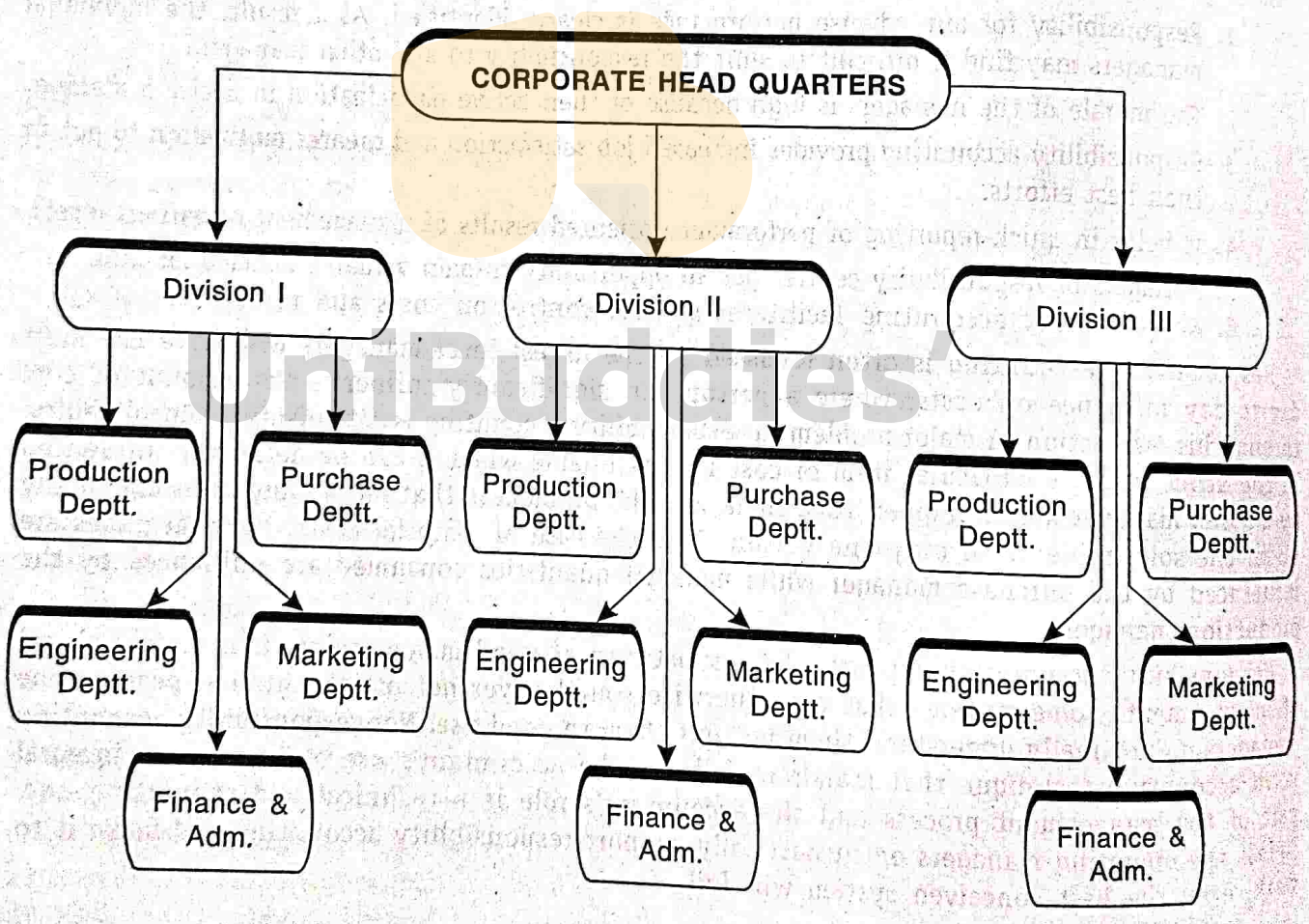

Fig. 7.1. Divisionalised Organisation Structure

Benefits

Studies have been conducted on the effect of autonomy allowed to divisional managers in matters of decision making. It was found that where divisional managers enjoyed decision making powers relating to production, selling prices, purchase policies etc., decision making has improved both in respect of quality of decisions and speed of decisions. A divisionalised organisation structure offers the following benefits :

1. It promotes quick decisions and avoids red tape and delays
2. Divisionalised structure motivates divisional managers to perform better. It also help to improve their job satisfaction and self fulfilment.
3. It makes the top management free from detailed involvement in the day to day operations and enables them to devote themselves to important policy matters.

Dangers

Divisionalisation has also certain demerits :

1. Various divisions may compete with each other and in that divisional managers may try to increase their own profits at the expense of other divisions.
2. The biggest problem faced by divisionalised structure is that there may be lack of coordination and cooperation between divisions. This results in lack of harmony in achieving overall goals of the business.

MEASUREMENT OF DIVISIONAL PERFORMANCE

The basic objective of responsibility accounting is to measure divisional performance so as to determine the contribution of each division in the total performance of a company. This provides a basis for evaluation of performance of each division and fixation of responsibilities for various off the mark performances. Various techniques used for measurement of divisional performance are explained below :

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1. Variance Analysis

This is a technique which has already been explained in the chapter an standard costing. In this technique, actual performance is compared with standard or budgeted performance and any variance between the two is analysis to know the causes so that responsibility can be established and corrective action taken. As applied to responsibility accounting, variance analysed should be undertaken for each cost centre and revenue centre to measure the performance of each such responsibility centre.

2. Profit

The absolute amount of profit revealed by a profit centre can also be used as a measure to judge its performance. However, this is not considered to be a very reliable measure of performance because the costs charged for computing profit may include direct divisional costs plus apportioned fixed overhead. Such allocation beings in the element of subjectivity.

3. Return on Investment (ROI)

Instead of considering the absolute size of a division's profit, most organisations prefer return on investment of a division as a measure of its performance. For example, if division A makes a profit of ₹ 2,00,000 and division B makes a profit of ₹ 1,00,000, can it be concluded that

division A is more profitable than B ? The answer is no because it cannot be said without reference to the amount of capital invested in each division. ROI expresses divisional profit as a percentage of firm's investment in the division. This is calculated as follows :

$$ROI = \frac{\text{Divisional Profit}}{\text{Divisional Investment}} \times 100$$

Also

$$ROI = \frac{\text{Profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital Invested}} \times 100$$

Assuming further in the above example, the capital invested in division A is ₹ 10 lakhs and that in division B it is ₹ 4 lakhs, the ROI will be calculated as follows :

$$\text{Division A – ROI} = \frac{₹\ 2,00,000}{₹\ 10,00,000} \times 100 = 20\%$$

$$\text{Division B – ROI} = \frac{₹\ 1,00,000}{₹\ 4,00,000} \times 100 = 25\%$$

ROI has reversed the conclusion because it proves that performance of division B is better than A as it's ROI is 25% as compared to 20% of A.

Advantages

ROI has several advantages.

1. ROI is a widely accepted measure of performance because it relates net income to investments made in the division.
2. ROI is a relative measure and not an absolute measures as it is expressed in percentage.
3. ROI is easy to understand and interpret.
4. ROI can motivate divisional managers to improve their performance by optimum utilisation of the capital invested in the division.

Limitations

ROI as a measure of performance is quite logical but suffers from certain operational limitations.

1. It is not always possible to accurately determine the amount of divisional investment. There may be problems of valuation of assets assigned to the investment centre/division. There are different methods of valuation of assets such as book value, original cost, current replacement cost, etc. which of these valuation is to be taken for calculating ROI remains a difficult question to answer.
2. There may also be some practical difficulties in calculating the divisional profit. Various concepts of profit to be considered may be profit before interest and tax, profit after interest and tax, profit after charging allocated fixed costs, etc. whether extra ordinary items of profit or losses should be excluded or not ? What should be the basis of charging depreciation and certain other costs in the computation of profit ? All these points need due attention for calculating divisional profit and there should be uniformity in the treatment of these so that these are comparable.

4. Residual Income (RI)

Residual income may be defined as the profit of a division less cost of capital used by the division. It is also known as Economic Value Added (EVA) method where EVA is profit minus the cost of invested capital in the division.

The rate of interest at which cost of capital is calculated may be notional and not actual and such a rate is specified by the top management. Thus residual income may thus be calculated as follows :

Residual income = Divisional profit – (Divisional investment × Rate of interest)

Suppose, a division's profit is ₹ 5,00,000 and average capital invested is ₹ 20,00,000 in the division for the year. If the cost of capital is 10%, residual income will be calculated as follows :

	Divisional profit	₹ 5,00,000
Less :	Cost of capital (20,00,000 × 10%)	₹ 2,00,000
	Residual income	₹ 3,00,000

Residual income tells how much a division's profit exceeds its cost of capital.

Advantages

1. Residual income method has the advantage of showing division's ability to earn more than the cost of capital. Any additional investment in a division will be acceptable if it increases the residual income *i.e.* if it yields an income which is higher than the cost of capital.
2. Divisional managers are made to realise that there is an opportunity cost of funds used by the division in the form of cost of capital.
3. It is generally felt that RI or EVA leads to better decisions than using ROI .

Limitations

1. It may be difficult to determine the rate for calculating the cost of capital.
2. Most of the operational difficulties in measuring divisional profit and divisional investment faced in ROI method are also present in calculating the residual income.

PROBLEMS AND SOLUTIONS

Problem 7.1

ABC Ltd. has three division A, B and C. The operatiang results of the three divisions are as follows :

	Divisions		
	A	*B*	*C*
	₹	₹	₹
Sales	5,00,000	5,00,000	10,00,000
Less: Cost	4,00,000	3,00,000	6,00,000
Profit	1,00,000	2,00,000	4,00,000
Investment	3,00,000	5,00,000	15,00,000

(i) You are required to determine ROI of the three divisions and rank these divisions on the basis of their performance.

(*ii*) Determine residual income (RI) of the three divisions and rank them assuming cost of capital is 15%.

Solution

(i) Performance Measurement Report (ROI)

	Divisions		
	A	*B*	*C*
$ROI = \frac{\text{Profit in ₹}}{\text{Investment in ₹}} \times 100$	$\frac{1,00,000}{3,00,000} \times 100$	$\frac{2,00,000}{5,00,000} \times 100$	$\frac{4,00,000}{15,00,000} \times 100$
	33.33%	40%	26.67%
Ranking	**II**	**I**	**III**

(ii) Performance Measurement Report (RI)

	Divisions		
	A	*B*	*C*
	₹	₹	₹
Investment	3,00,000	5,00,000	15,00,000
Profit	1,00,000	2,00,000	4,00,000
Less: Cost of capital @ 15% on investment	45,000	75,000	2,25,000
Residual Income (R1)	55,000	1,25,000	1,75,000
Ranking	III	II	I

Problem 7.2

Xpro India Ltd has three divisions. It is considering to make additional investment in one of these divisions. The relevant information is given below :

	Division X	Division Y	Division Z
	₹	₹	₹
Additional investment	5,00,000	5,00,000	5,00,000
Net profit on additional investment	70,000	65,000	85,000
Current ROI	15%	16%	14%

The cost of capital is 12%. In which division should the investment be made ?

Solution

1. ROI Method

	Divisions		
	X	*Y*	*Z*
ROI on new investment $= \frac{\text{Net profit}}{\text{Additional investment}} \times 100$	$\frac{70,000}{5,00,000} \times 100$	$\frac{65,000}{5,00,000} \times 100$	$\frac{85,000}{5,00,000} \times 100$
	= 14%	= 13%	= 17%
Current ROI	15%	16%	14%

Conclusion. Investment should be made in division Z because ROI on additional investment is higher at 17% against its current ROI of 14%. In division X and Y, ROI on additional investment is less than current ROI. Thus additional investment in Division X and Y should not be accepted.

2. RI Method

	Divisions		
	X	Y	Z
	₹	₹	₹
Additional investment	5,00,000	5,00,000	5,00,000
Net profit	70,000	65,000	85,000
Less: Cost of capital @ 12% on investment	60,000	60,000	60,000
Residual Income (RI)	**10,000**	**5,000**	**25,000**

Conclusion. Additional investment should be made in division Z as it gives the highest residual income.

Problem 7.3

The food division of South McDown Food shows the following results for the year ended 31st March 2018.

Turnover	₹ 80,00,000
Costs :	
Materials	21,00,000
Labour	6,60,000
Production overhead	6,00,000
Apportioned group costs	6,40,000
Total cost	40,00,000
Other divisional information :	
Fixed assets investment	₹ 130 lakhs
Working capital	₹ 30 lakhs
	₹ 160 lakhs

Cost of capital is 13.75% as a weighted average rate on the total capital employed.

Comment on the management performance of the division using—

(a) ROI method and

(b) RI/EVA method

Solution

1. ROI (Return on Investment) Method

Net profit = Sales – Total cost

= ₹ 80,00,000 – 40,00,000 = ₹ 40,00,000

$$\text{ROI} = \frac{\text{Net profit}}{\text{Divisional Investment}} = \frac{₹\ 40,00,000}{1,60,00,000} = 25\%$$

This 25% is a very good return on capital employed

$$\text{Assets turnover} = \frac{\text{Turnover}}{\text{Divisional Investment}} = \frac{₹\ 80\ \text{lakhs}}{₹\ 160\ \text{lakhs}} = 0.5\ \text{times}$$

This means business is generating only 0.50 times its capital base in the form of turnover, which appear to be quite unsatisfactory.

2. RI (Residual Income)/EVA (Economic Value Added) Method

Cost of capital = Divisional investment × Cost of capital
= ₹ 1,60,00,000 × 13.75% = ₹ 22,00,000.

Divisional Profit	=	₹ 40,00,000
Less : cost of capital		₹ 22,00,000
RI/EVA		₹ 18,00,000

Thus the division has achieved an earnings of ₹ 18 lakhs in excess of the cost of financing the division.

KEY TERMS

Responsibility accounting is a system of accounting that segregates revenues and costs into areas of personal responsibility in order to monitor and assess the performance of each part of an organization.

Responsibility centre "is a division of the organisation, where an individual manager is held responsible for its division's performance."

Cost centre. A responsibility centre is a cost centre where the manager is accountable for the costs that are under his control.

Revenue Centre. A responsibility centre is a revenue centre in which manager controls revenues.

Profit centre A responsibility centre is a profit centre where the manager is accountable for sales revenue as well as costs

Investment centre. A responsibility centre is an investment centre where is manager is responsible for sales revenues and costs and in addition is responsible for some capital investment decision relating to working capital management, capital structure and capitalisation, etc.

EXAMINATION QUESTIONS

Objective Type Questions

True or False ?

1. Responsibility accounting can be used only in decentralised companies.
2. In an investment centre, the manager is responsible only for investments decisions and not for its costs and sales revenues.
3. Responsibility accounting includes variance analysis.
4. Responsibility accounting provides greater motivation to managers to put in best efforts.
5. Responsibility accounting is more suitable in diversified companies.
6. Responsibility accounting is an accounting technique.
7. In a revenue centre, the manager is responsible for costs as well as revenues.
8. In measuring the performance of an investment centre, a division with a higher return on investment (ROI) and a lower residual income (RI) will be considered more profitable.
9. In divisionalised organisation structure, generally there is better coordination and cooperation between divisions.
10. ROI is a widely accepted technique of measurement of divisional performance.

[**Ans.** 1. False, 2. False, 3. True, 4. True, 5. True, 6. False 7. False, 8. False, 9. False 10. True]

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Eassy Type Questions

1. Discuss responsibility accounting in brief. *(B. Com Hons. Delhi)*
2. What is responsibility centre ? Discuss briefly the nature and various types of responsibility centres. *(B. Com Hons. Delhi)*
3. Write explanatory note on responsibility accounting *(B. Com Hons. Delhi)*
4. Write short notes on responsibility centres — cost centre and profit centre. *(B. Com Hons. Delhi)*
5. Outline the basic principles of responsibility accounting. *(B. Com Hons. Delhi)*
6. What are the different methods of measurement of divisional performance ?
7. Explain the following methods of measuring performance of responsibility centres and evaluate them :
   (*i*) Return in investment
   (*ii*) Residual income

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ABOUT THE AUTHOR

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